

Assessing Cumulative Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mine Development in the Eastern Slopes of Southern Alberta.



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Executive Summary

Since the turn of the century an area known as the Pekisko Rangelands in the Foothills of the Livingstone range, abundant with native prairie grasses, has supported the growth of multi-generational cattle ranching operations that produce world-class Alberta beef. On June 1st, 2020, the Government of Alberta rescinded A Coal Development Policy for Alberta, which was also commonly known as the "1976 Coal Policy". Rescission of the Coal Policy removed all restrictions on issuing coal leases within the former coal categories 2 and 3, including grazing allotment areas and altered land management in the Southern Rockies.

Exploration activities have commenced at five of the previously undeveloped lease areas (Chinook Vicary, Elan South, 4 Stack, Isolation South, Cabin Ridge) and Montem Resources is in the process of applying for an amendment to EPEA, along with several other licences to develop the Tent Mountain mine Project.

Metallurgical surface coal mining in the United States and Australia have been well studied, largely driven by public health concerns. Results of these environmental and human health studies elated to metallurgical coal mine developments in British Columbia and across the globe provide evidence show a consistent association of air impacts from coal mining and higher mortality and morbidity from cancer, respiratory and cardiovascular diseases, and congenital anomalies in populations close to surface coal mines. Generally, particulate matter released from fugitive dust emissions at operating surface coal mines are identified as the primary contributor to health impacts in nearby communities.

As stewards of these lands for generations, The Pekisko Group requires accurate and reliable information to understand potential risks to their livelihoods, support engagement with municipal, provincial, and federal governments regarding policy, regulation, and land use planning, and to inform discussions with prospective developers.

To understand potential health risks, the Pekisko Group has commissioned this research study which assesses and describes potential air quality impacts and risks to forage crop, livestock, and ranching family health from development of metallurgical coal mine leases in the Livingstone Range.

A Planned Development Scenario (PDC) integrating eight operative mines (Grassy Mountain, Tent Mountain, Elan South, Isolation South, Cabin Ridge, Isola, Four-Stack, Chinook Vicary) was developed using available information from coal mine project applications and published reports of mine development in the Livingstone area. The PDC was used to develop source inputs undertake air dispersion modelling with the CALPUFF model to predict the concentration and deposition of gaseous and particulate matter released from the cumulative mine scenario.

Predicted concentrations of gaseous compounds (SO₂ and NO₂) and fugitive dust (PM_{2.5}, PM₁₀, TSP) under the PDC were detected across the study area which includes grazing allotments, recreational areas, cabins, ranching operations, and residences. Generally, SO₂ and NO₂ were dispersed more broadly across the study area and particulate matter was elevated in closer proximity to the mine sites.

Predicted concentrations of the following air contaminants were identified as potential risk factors that could contribute to deteriorated human and environmental health conditions specified as the protection goal for each contaminant over acute (short term) and chronic (long term) exposure periods related to air emissions from the coal mine PDC in the Livingstone area:

- *Respiratory effects associated with Nitrogen dioxide concentrations (short- and long-term)*
- *Respiratory effects associated with larger diameter particulate matter (TSP and PM₁₀) concentrations (short and long term)*
- *Respiratory effects associated with particle bound arsenic concentrations (short term) and nickel and lead (long term)*
- *Cardiovascular effects associated with smaller diameter particulate matter concentrations (PM_{2.5} and PM₁₀) (long term)*
- *Soil acidification from deposition of sulphur and nitrogen acid compounds (further assessed in the vegetation health assessment)*

Generally, estimated risk quotients and the number of parameters exceeding safe exposure levels were the highest on mine sites followed by Plateau and Blades cabin. Recognizing that ranching operations and cattle move freely within government issued grazing allotments it cannot be assumed that cattle and human receptors would not be present at or near the MPOI. The risk predictions for each of the three locations should be considered equally to understand potential health risks from the coal mine PDC in the Livingstone area.

The identified deteriorated air quality conditions related to NO₂, PM_{2.5}, PM₁₀ and TSP (identified by comparison to provincial, federal, and global air quality guidelines, standards, and objectives) were further predicted to deteriorate soil quality condition within the study area from deposition of particulate bound metals and naphthalene and acid forming compounds.

Deposition of particulate bound antimony, cadmium, selenium, and naphthalene were predicted to exceed soil quality guidelines established for the protection of soil quality and the health of associated biota (invertebrates and plants) and connected media (surface water and groundwater). The weight of evidence between these two lines of enquiry indicates that direct health effects (such as decreased growth) to forage crops from metal exposures may be low but that bioaccumulation of metals by plants and ingestion by cattle was identified as a risk factor from the coal mine PDC.

Potential risks to forage crop, livestock, and human health from the coal mine PDC were assessed through a multi-media risk model which estimates the uptake and movement of contaminants deposited to soil from plants to livestock and finally ranching families. The risk model was developed to assess exposure of livestock and ranchers from two exposure pathways; inhalation of air contaminants and ingestion from a primary food source (forage crops for cows and beef for humans) under two dust suppression scenarios (50% and 0% mitigation) and consideration of how baseline soil concentrations may contribute to risk.

Potential risks to cattle (cows) from ingestion of forage crops at grazing allotments in the PDC were the highest identified risk factor and should be considered the primary risk driver when considering impacts to agricultural land uses. Potential risk to cows ingesting forage crops under the PDC when at the grazing allotments were identified for several metals: Antimony, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Nickel, Selenium, Thallium, Vanadium, Zinc. There were no predicted risks from exposure to PAHs deposited to soil from diesel exhaust emissions. Risks were also predicted for nursing calves (from exposure to barium, beryllium, copper, nickel, thallium, vanadium, zinc) and adult ranchers (from exposure to arsenic).

The predicted deteriorations in air conditions, localized changes to soils and biodiversity, and uptake of metals by forage crops and exposure of cattle (cows and calves) and adult ranchers at grazing allotments under the coal mine PDC which considers 8 operating metallurgical coal mines (Grassy Mountain, Tent Mountain, Elan South, Isolation South, Cabin Ridge, Isola, Four-Stack, Chinook Vicary) could result in adverse chronic health effects cattle herds and operations (at grazing allotments in the foothills Livingstone Range) and to lesser extent the health of local ranchers.

There are potentially localized exceedances of critical loads of acidity for soil within Grazing Allotments within and in the vicinity of the Elan South, Isola and Isolation South mine lease areas in the Planned Development Case. In the absence of site-specific soil geochemical characterization and critical load determination, qualitative and/or pseudo-quantitative models based on literature and regional surficial geology/soils mapping provide the only way to make these predictions.

Localized impacts to grazing quality may occur in the Planned Development Case due to Nitrogen (N) deposition. Further study on the species-level sensitivity and geographical extents of high-quality forage ecological communities is needed to understand the impacts of coal development on grazing pasture health in the region. Financial consequences to cattle ranching due to the combined impacts of decreased forage quality, impaired ecosystem resilience, and climate-change-induced drought severity, is a plausible outcome of intensive coal mining in the region.

The study presented here provides an indication of the potential impacts to air quality and risks to agricultural land use (ranching operations) and users (ranching families) in the Livingstone range. Further studies are required to establish the existing condition of air and soil quality in areas where metallurgical coal mine developments are proposed in the Livingstone area. The lack of monitoring data is currently limiting the accuracy and applicability of air dispersion modelling studies and assessment of potential risks.

Studies are also required to validate the assumptions and uncertainties identified in this report and to support a more thorough assessment of the potential impacts to water quality from coal mine developments and the associated risks to forage crops, cattle, and residents in the Livingstone area. It is recommended that these studies be completed prior to policy and development decisions to ensure the land does not become unusable for the predominant industry in the area, which is currently agriculture.

It is recommended that the provincial government undertake an assessment of potential health impacts from metallurgical coal mine development in the Eastern Slopes that is supported by the departments responsible for developing policy and regulating development. Specifically, Alberta Health, Alberta Agriculture, Alberta Environment and Parks, and the Alberta Energy Regulator must consider the published scientific and monitoring data related to health impacts from metallurgical coal mine developments in other jurisdictions (Australia, United States) and integrate these into assessments to support the development of future policy and regulations in Alberta.

Introduction

The Pekisko Group, a local landowner initiative was founded in 2000 by 40 ranching families who came together out of concern for the future of rangelands on the eastern slopes south of the Highwood River. In 2007 the Pekisko Group was recognised as “Rangemen of the Year” by the Rangemen’s Association and in 2013 received international recognition for “Outstanding Achievement” from the Society for Range Management.

To Ranching families, many who have evolved ranching operations in the area over the last 120 years, the eastern slopes are regenerative assets essential for sustainable food and water production.

“As you look around, you can see these natural landscapes of the Eastern Slopes occupy a relatively small area in the province, but they are hugely significant for their diversity of habitat and water production. To the North we can see the Foothills Fescue grasslands. As you Pan west you can see examples of Montane ridges, Foothills Parkland, then the mixed wood of the Lower Foothills, the conifer dominated Upper Foothills, that give way to the subalpine subregions at higher elevation. Rough Fescue Grasslands are intermixed with all the Foothills subregions.”

Gordon Cartwright (Excerpt from August 24, 2021 Coal Panel Presentation)

An important land use in the Pekisko Heritage Rangelands not considered in the sale of coal leases, recent coal mine project applications, and planned development, includes cattle grazing allotments and summer working residences for ranchers.

“We have a community where we know our neighbours. Our families have lived and ranched here for over 100 years. Our M.D. is called Ranchland. Almost exclusively the people who live in Ranchland are ranchers. We raise cattle.

A portion of our cattle herds graze forestry allotments from June 15 to October 15. The allotments are located in the foothills of the Rockies in the headwaters of the Oldman and Livingstone Rivers. The exact location that is now being threatened by proposed Australian coal mines.

The sixteen ranch families depend on this summer pasture to graze approximately 2500 cow/calf pairs.

Without this summer native grassland these families could not maintain their herds. This native grassland is not replaceable there is no more of it.

From the Oldman River to Pekisko Creek and east to Hwy.22 approximately 26,000 head of cattle graze native grassland.

This is the heart of ranching country and the best in the world.”

-Mac and Renie Blades (Excerpt from August 24, 2021 Coal Panel Presentation)

As stewards of these lands for generations, The Pekisko Group requires accurate and reliable information to understand potential risks to their livelihoods, support engagement with municipal, provincial, and federal governments regarding policy, regulation, and land use planning, and to inform discussions with prospective developers.

To date, neither the provincial government or prospective coal companies have provided a cumulative effects assessment of the potential impacts from development of coal leases in the Livingstone Range.

Given the limited information currently available, potential health risks to residents, livestock and forage crops are unknown and will not be understood until industry proponents submit regulatory applications to develop coal mines.

To understand potential health risks, the Pekisko Group has commissioned this research study which assesses and describes potential air quality impacts and risks to forage crop, livestock, and ranching family health from development of metallurgical coal mine leases in the Livingstone Range.

Background

The Livingstone Range is a sub-range of the Canadian Rockies in Alberta, Canada. It forms the eastern boundary of the Rockies in the south of the province. Its northern boundary is the Highwood River, and it extends to the Crowsnest Pass in the south. The Livingstone and Oldman Rivers bound it to the west (Alberta Environment and Parks (AEP), 2018a).

Alberta is divided into seven Land Use Regions (LURs), the Livingstone Range and Southern Rockies lie within the South Saskatchewan Region (SSR), and within this region is a unique ecosystem, the Pekisko Heritage Rangeland, as shown in Figure 1 (Government of Alberta (GOA), 2008).

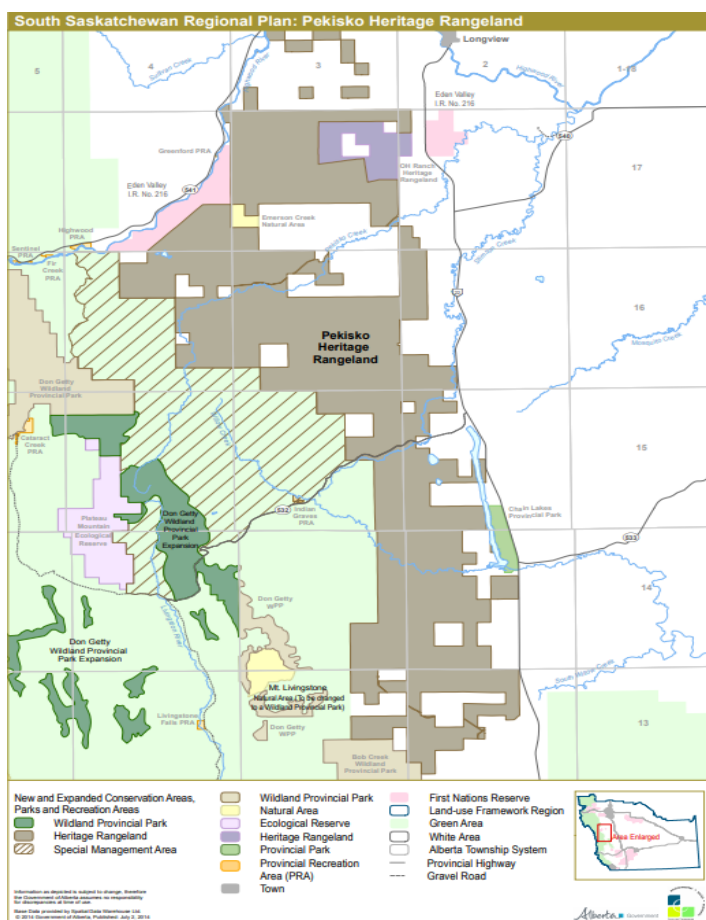


Figure 1. Pekisko Heritage Rangeland and South Saskatchewan Region (inset) adopted from the South Saskatchewan Regional Plan (GOA, 2018) Published at:
<https://landuse.alberta.ca/SiteCollectionDocuments/SSRP%20Pekisko%20Heritage%20Rangeland%20-%202014-07.pdf>.

Land Use and Management in the Livingstone Range

The SSR covers ~84,000 km² (13% of the province) and is dominated by grassland ecosystems which cover roughly 78% of the area. Comparatively, the Rocky Mountains (15%), and Foothills (2%) cover much smaller areas (Alberta Biodiversity Monitoring Initiative (ABMI), 2018).

Despite the transformation of large areas by human activity (~52%), substantial areas of native grassland still remain intact and support the continued growth and development of the agricultural sector in the SSR. Jaremko, S.L. (2016) identified agriculture as the primary land use (67.2%) with grazing accounting for 26.7%. The ABMI (2016) also identified agriculture as the dominant land use in 2016, as shown in Figure 2.

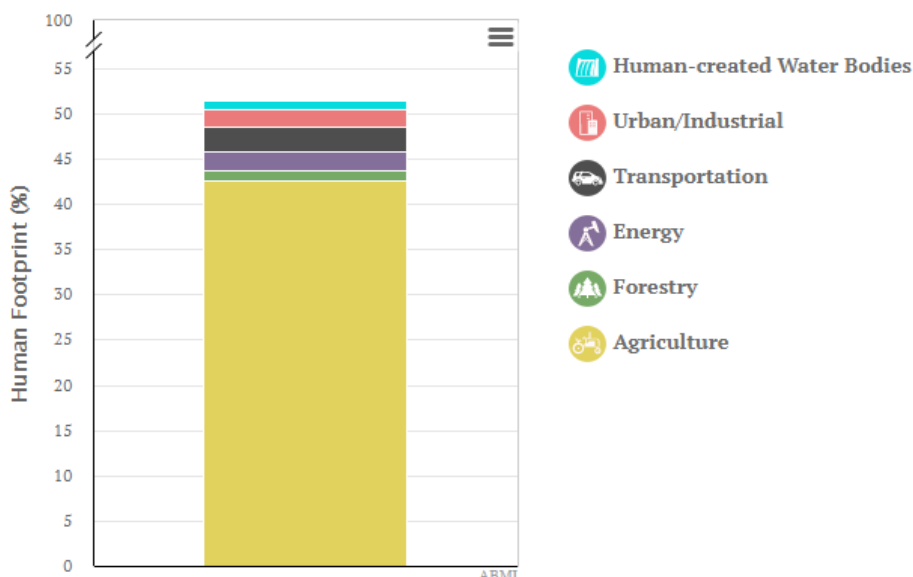


Figure 2. Status of Human Footprint. Summary of percentage cover of total human footprint broken down by human footprint category in the South Saskatchewan Region (Adopted from ABMI (2016) published at: <https://abmi.ca/home/reports/2018/human-footprint/details.html?id=7>).

Due to human (anthropogenic) development and population growth in the Livingstone Area the Government of Alberta (GOA) developed the Livingstone-Porcupine Hills Land Footprint Management Plan (2018) to preserve the highly valued components of the area: headwaters, westslope cutthroat trout, Foothills fescue grasslands, recreational opportunities and scenic value (AEP 2018).

The Livingstone-Porcupine Hills Management Plan is implemented in addition to, the South Saskatchewan Regional Plan (SSRP) and associated Environmental Management Frameworks (EMFs), all of which is applied under the Alberta Land Stewardship Act (ALSA) as described in the Alberta Land Use Framework Integrated Plan (AEP, 2018b).

Together, the Livingstone-Porcupine Hills Land Footprint Management Plan and SSRP (including EMFs for air and surface water quality) provide government, industry, public, and Indigenous community stakeholders the framework under which land use is managed to achieve desired outcomes for this area, as established in the plan (AEP, 2018b):

1. The region's economy is growing and diversified.
2. Air quality is managed to support healthy ecosystems and human needs through shared stewardship.
3. Biodiversity and ecosystem function are sustained through shared stewardship,
4. Watersheds are managed to support healthy ecosystems and human needs through shared stewardship.
5. Land is used efficiently to reduce the amount of area that is taken up by permanent or long-term developments associated with the built environment.
6. The quality of life of residents is enhanced through increased opportunities for outdoor recreation and the preservation and promotion of the region's unique cultural and natural heritage.
7. Aboriginal peoples are included in land-use planning.
8. Community development needs are anticipated and accommodated.

In considering the outcomes as described in the SSRP, it is necessary to understand how the land is currently used and can be affected by future development.

The Pekisko Rangelands

Since the turn of the century an area known as the Pekisko Rangelands in the Foothills of the Livingstone range, abundant with native prairie grasses, has supported the growth of multi-generational cattle ranching operations that produce world-class Alberta beef. This area is more accurately classified as the Foothills Fescue Natural Subregion in the Grassland Natural Region and in 2005 (Adams, B.W., et. al.,) estimated that only 16.8% of this area remained intact.

Regardless of the loss of large areas of fescue, ranching operations in the Pekisko Heritage Rangelands and Foothills continue to thrive through a novel approach to grazing utilizing both private and public grazing areas, as noted in the Livingstone-Porcupine Hills Management Plan (GOA, 2018);

"Grazing is another significant land use, with ranching being a primary income source for a large number of residents".

Cattle graze on native prairie in lower areas through winter to calving in early spring. In late spring, cattle herds are moved to government issued grazing allotments on public lands in the higher foothills areas where calves will gain most of their body weight as shown in **Error! Reference source not found.**

Therefore, protection of the remaining high-quality fescue grasslands in the foothills and Pekisko rangelands is integral to the continued operation of large-scale multigenerational ranching operations in this area.

Proposed Metallurgical Coal Mine Development in Southern Alberta

On June 1st, 2020, the Government of Alberta rescinded A Coal Development Policy for Alberta, which was also commonly known as the "1976 Coal Policy". Rescission of the Coal Policy removed all restrictions on issuing coal leases within the former coal categories 2 and 3, including grazing allotment areas described in **Error! Reference source not found.** and altered land management in the Southern Rockies.

Prior to suspending public offerings (sales) of coal leases on Category 2 lands (GOA, 2021) and re-instating the Coal Policy on February 8th, 2021 (GOA, 2021b) approximately 840,000 hectares of coal leases were

purchased by several companies as shown in Figure 3. Of the leased area, 11 leases equivalent to 0.2% of the leased area were subsequently cancelled (GOA, 2021d).

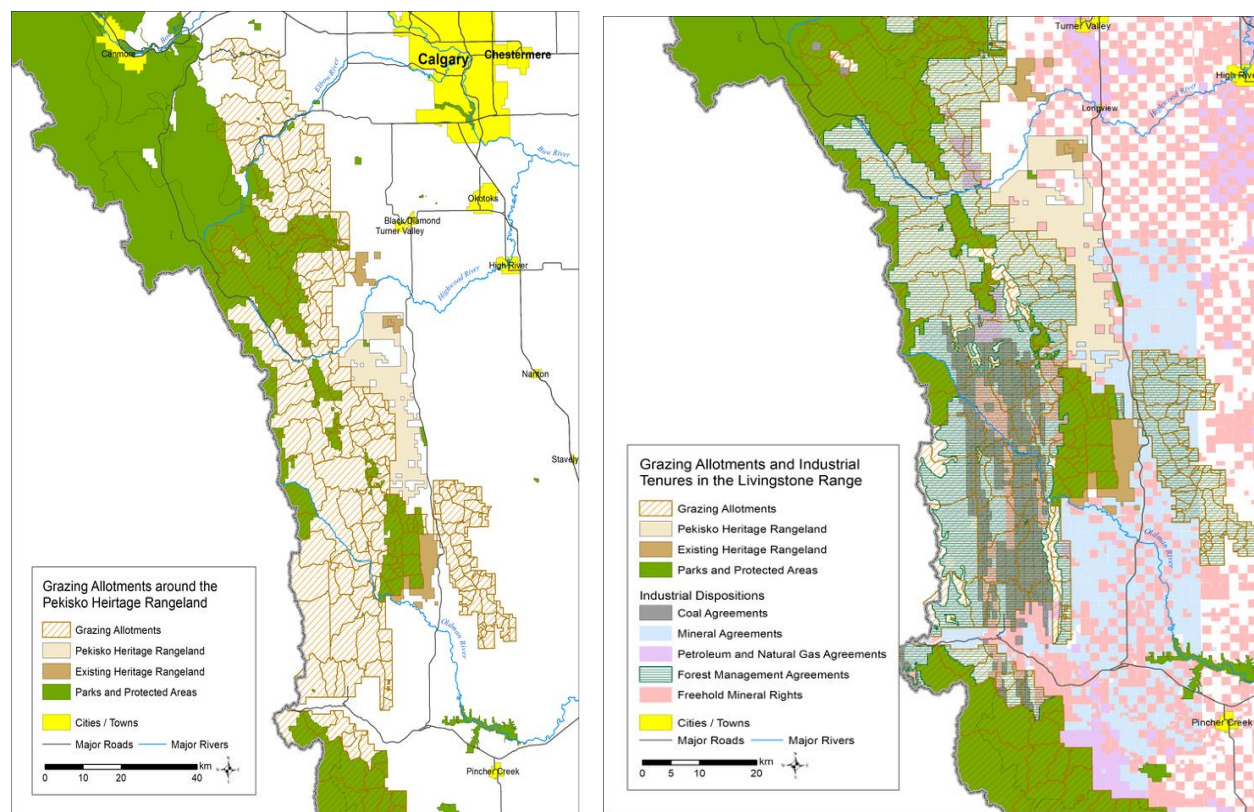


Figure 3. Representation of the changing landscape in the Pekisko Heritage Rangelands and Livingstone Range and foothills area from overlapping land uses permitted by the Government of Alberta and Alberta Energy Regulator for grazing allotments, coal leases and logging activities.

Information regarding the exploration and proposed development of the coal leases shown in Figure 5 varies between government and independent sources. As of March 2021, the GOA reported 3 exploration activities (Chinook, Cabin Ridge, Elan) (GOA 2021c). Comparatively, Stelfox, B. and Donahue, B. (2021) provide a comprehensive review of industry reporting and identify eight potential metallurgical coal mine projects as shown in Figure 4 ([links to industry website](#)); Riversdale Resources (*Grassy Mountain project*), Montem Resources (*Tent Mountain project*), the Atrium proposals (*Isolation South, Elan South*), Warburton's Cabin Ridge project, and Montem's northern proposals (*Isola, 4-Stack, Chinook*).

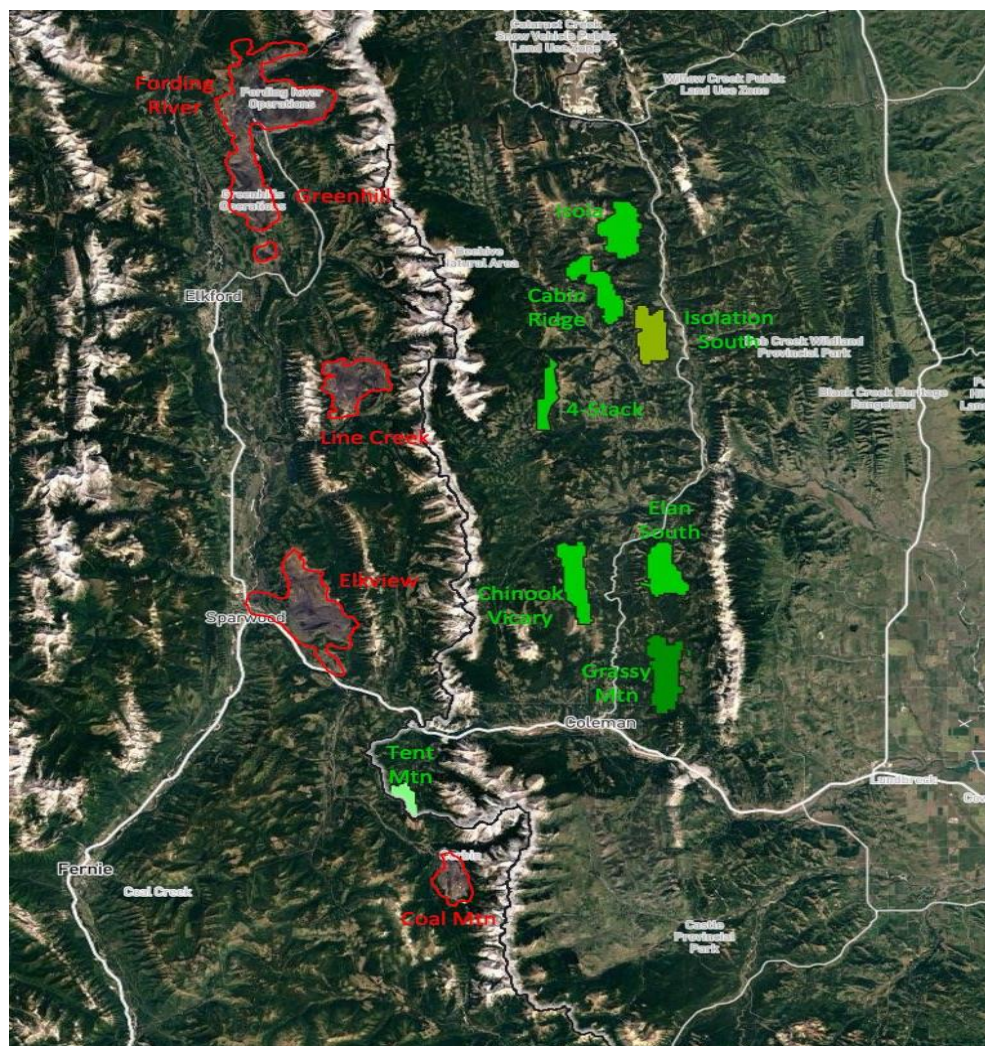


Figure 4. Eight prospective coal mine projects in the headwaters of the Oldman River Watershed (green). This image also shows the visible boundary of direct footprint of existing coal mines in the Elk Valley of southeast BC (red). Adopted from Stelfox, J.B, and W.F. Donahue. 2021. *Assessing watershed scale consequences of coal surface mines in the headwaters of the Oldman River Watershed (ORW)*. Report prepared for the Livingstone Landowners Group.

Of the project areas shown in Figure 4, an application was submitted and subsequently denied by the Alberta Energy Regulator and Government of Canada for the Grassy Mountain Coal Mine (Alberta Energy Regulator, 2021; 2021; Government of Canada, 2021; Canadian Environmental Assessment Agency, 2021).

Exploration activities have commenced at five of the previously undeveloped lease areas (Chinook Vicary, Elan South, 4 Stack, Isolation South, Cabin Ridge) and Montem Resources is in the process of applying for an amendment to EPEA, along with several other licences to develop the Tent Mountain mine Project (Montem Resources, 2021).

Recent coal mine leasing, exploration and applications as discussed above make it evident that metallurgical coal mining is a potential increased land use in the Oldman River Watershed. Predicted alterations and negative impacts to water quality, hydrology, and fish habitat from metallurgical coal mine development were recently published by Stelfox, B. and Donahue, B. (2021) and Chernos, M. et. al. (2021).

These studies were not designed to assess potential risks to human or environmental health from other stressors linked to coal mining, such as deteriorated air quality and risks to human, environmental, livestock and crop (forage and grazing) health. While the predicted deterioration and impacts to water quantity and quality, riparian habitat, and species at risk are significant, there are additional concerns and risks to the environment and humans from deterioration of air quality which have not been studied.

Surface Coal Mining, Air Quality and Public Health

A scientific literature review to identify potential sources of air contaminants and health risks related to surface coal mining is provided below.

From the available literature, it is evident that surface coal mining operations (open pit or mountain top removal) contributes to deteriorated air quality through emissions of fugitive dust (from blasting, mining and haul roads) and gases (from mine fleet equipment and processing facilities) (Hendryx et. al 2020; RWDI, 2020; Boyles, 2017; Kurth et. al., 2014; Aneja, V., et. al., 2012).

Results from epidemiological studies provide evidence which can be conclusively used to determine the cause of health-related incidents and are the strongest indicator of adverse health outcomes related to surface coal mining activities (Cortes-Ramirez, J., et. al., 2019). Independent studies and review articles show a consistent association of coal mining with higher mortality and morbidity from cancer, respiratory and cardiovascular diseases, and congenital anomalies in populations close to surface coal mines in the United States, China, Spain, and the United Kingdom (Cortes-Ramirez, J.M., et. al., 2018).

Particulate matter in fugitive dust emissions has been conclusively linked to increased mortality and morbidity (increased risk of cancer, cardiovascular and respiratory disease, congenital anomalies) in communities closer to coal mine operations when compared to residents in communities without coal mining activity nearby (Gohlke, J.M., 2021; Small, D.S. 2021; Hendryx, M. et al., 2020; Cortes-Ramirez, J, 2018; Espitia-Perez, L, 2018; Boyles, A.L. et al., 2017; Hendryx, M. and Luo, J., 2015; Ahern, M. and Hendryx, M, 2012; Ahern, M. et al., 2011; Esch, L. and Hendryx, M, 2011).

Air monitoring data at or near operating surface mines in British Columbia (RWDI, 2018; 2019; 2020) and Australia (Hendryx, M., et. al., 2020) indicate that contaminants which most frequently exceed health-based thresholds include: particulate matter, sulphur dioxide and nitrogen dioxide.

In addition to being respirable and exposing nearby residents, particulate matter and bound trace elements, heavy metals and polycyclic aromatic hydrocarbons (PAHs) can be deposited to nearby soils and surface water (Han, F. and Zhang, Y., 2017; Hu, Z.Q. et. al., 2014) increasing the exposure of plants, animals, and humans in these areas to potentially toxic levels of metals (Maqbool, A. et. al., 2019; Halim, M.A. et. al., 2015; Cai, L.M. et. al., 2015). Deposition of dust can also directly impact the health of forage and agricultural crops (Hota, P. and Behera, B., 2015; Farmer, A.M., 1991).

Gaseous compounds (NO_x, SO₂) emitted from explosives, haul trucks, mining equipment and processing facilities (Oluwoye, I. et. al., 2017; U.S. EPA 2010; U.S. EPA 1996) may also contribute risk from the formation and deposition of acid compounds (Alberta Environment (AENV), 2008) which can increase the bioavailability of heavy metals (Wilson, M.J. and Bell, N., 1996), directly affect plant health (Nagajyoti, P.C. et al, 2010; Mayer, R. 1991), and further contribute to potential health risks in humans and animals from

ingestion of metals in local plants and wildlife in these areas (Xiao, X., et. al., 2020; Martinez, R.E., et. al., 2013; Masto, R.E., et. al., 2011).

Generally, particulate matter released from fugitive dust emissions at operating surface coal mines poses the greatest health risk to nearby communities, livestock, and agricultural operations for air related exposure pathways.

Elk Valley Operations (British Columbia)

The higher rank metallurgical coal resources of the Luskar and Kootenay groups in the Mist Mountain Formation runs along the western and eastern slopes of the Rocky Mountains resulting in geochemically similar coal resources in Southern Alberta and British Columbia (Alberta Geological Society, 2020; Smith, G. and Cameron, A., 1990; Macdonald, D.E. et. al., 1989).

The unique and differential development of metallurgical coal resources between Alberta and British Columbia have produced a situation whereby the Elk Valley (in the western slopes) provides an exposure/developed test group while the Eastern Slopes of Alberta are similar to a control/undeveloped group (*The Narwhal*). Teck Coal Ltd. (Teck) operates four and maintains one open pit coal mine operations in the Elk Valley: Coal Mountain (CMO), Elkview (EVO), Line Creek (LCO), Greenhills (GHO) and Fording River (FRO).

Effectively, coal mining operations in Elk Valley on the western side of the great divide provide a case study to support predictions of environmental and human health impacts associated with coal mine development along the Eastern Slopes of Alberta, when local geography and meteorology are integrated.

Health studies related to surface coal mining in Canada and the Elk Valley were not available. However, several articles voicing community concerns over deteriorated air quality from coal mine dust from the Elk Valley Operations in BC were available (*The free press, Patagonia, Global*) as was industry reporting from local air quality monitoring and management activities at this operation (*Management Plan*; RWDI, 2018;2019;2020).

During the permitting process, each of the five EVO mines was authorized to release specified concentrations or loads of chemical and physical contaminants to the air with the condition that off-site ambient air quality is monitored, assessed against provincial and federal air quality objectives, and reported to the provincial regulator.

A summary of the most recent air quality monitoring data for six parameters (particulate matter (less than 2.5 and 10 microns (PM_{2.5}; PM₁₀)), Total Suspended Particulates (TSP), Nitrogen dioxide (NO₂), Sulphur dioxide (SO₂), and Carbon Monoxide (CO) from eight regional monitoring stations (2018) for the past 3 years (2017-2019) is provided below (RWDI, 2018;2019;2020).

- The number of complaints related to deteriorated air quality and dust management received from community members has steadily increased over the three-year period; 27 (2018), 158 (2018), 241 (2019).
- Annual SO₂ concentrations exceeded the Canadian Ambient Air Quality Standard (CAAQS) in 2019 but not 2017 or 2018.

- Concentrations of PM_{2.5}, PM₁₀ and TSP consistently exceed daily and annual objectives but the number of exceedances varies by year and contributions from mining activities can not be differentiated from those influenced by wildfire conditions.
- Data from 2010-2019 was presented graphically but a statistical analysis for trend detection was not provided.
- Additional air quality management measures such as increased public awareness and engagement and discontinuation of the coal haul road between two mines, were taken in 2019 to address the increasing number of public complaints.

The annual air monitoring reports provide minimal interpretation of reported air quality data, the results indicate that open pit metallurgical coal mining operations can deteriorate regional air quality (as indicated by exceedances of annual objectives for PM_{2.5} and SO₂) after implementation of air management and dust suppression activities and that the deteriorated air quality is a nuisance and health concern to local residents (as indicated by the increasing number of complaints).

Proposed Grassy Mountain Mine (Alberta)

While useful in understanding deterioration of air quality from operating coal mines and natural stressors, the industry reporting discussed above does not attribute air quality impacts to sources at operating mines, provide a comparison of the predicted air quality to observations to inform usefulness of modeling exercises, or directly relate to coal mine development in the southern Eastern Slopes.

A predictive air quality study undertaken to support the Grassy Mountain Mine project in southern Alberta was available to support this review (*Millenium EMS Solutions, 2016 and addendums*). The air quality study provides an indication of air emission sources associated with surface mining operations using scientific advancements and technology of the day as well as consideration of local geography and meteorology in southern Alberta.

Deteriorated air quality was predicted within a 35 km radius of the project during construction and operating phases from gas emissions (O₃, NO₂, SO₂, CO, PM_{2.5}) contributed by mobile equipment, locomotives and explosives and particulate matter (PM_{2.5}, PM₁₀, TSP) from fugitive dust emissions.

The substances identified in the Grassy Mountain air quality study are in general concordance with the parameters monitored at the Elk Valley operations, providing a good indication of how predicted air quality may correlate with observed air quality data.

However, comparison of predicted to measured air quality data between the Grassy Mountain Mine and Elk Valley operations is not appropriate based on differences in geography and meteorology between the Eastern and Western slopes and consideration of a single operating mine in the Grassy Mountain Mine project application. A cumulative modelling scenario which considers the eight proposed mines operating at the same temporal scale would be required to undertake this comparative analysis.

Expanding the literature review more broadly to other regions with well developed coal industries provides an indication of public health concerns and impacts from non-occupational exposures to coal

dust. Several areas of intense development which have been widely studied were identified in the United States¹, Australia², China³, and India⁴.

Metallurgical surface coal mining in the United States and Australia have been well studied, largely driven by public health concerns. The United States has similar policy and regulatory systems (with respect to industrial development and environmental guidelines) when compared with Alberta and was selected for a more in-depth analysis of available literature to support a discussion on potential air quality and health impacts from surface coal mine development.

The information summarized below, from decades of scientific studies in the Appalachian Mountains of West Virginia, should be considered by curators of policy and regulations to inform development of coal resources in Alberta as the weight-of-evidence clearly indicates that high-magnitude, long term development of surface coal mines in areas with mountain-valley topography and meteorology will contribute to deteriorated air quality and adverse health outcomes in local populations.

Appalachian Mountains, West Virginia (United States)

The Appalachian counties of West Virginia in the United States have a high density of mountaintop coal mining which has driven public health concerns. Epidemiological and environmental monitoring studies related to these coal mining activities provide the most comprehensive long-term dataset related to potential health effects associated with surface coal mining. Review and summary of scientific findings from the large volume of published data over the past 40 years are available (Cortes-Ramirez, J.M., et. al., 2018; Kurth et. al., 2014, Aher et. al., 2011) and will not be reproduced here.

Generally, increased prevalence of the following adverse health effects in nearby communities has been correlated with surface coal mines in the Appalachian Mountains, when compared to non-exposed community groups. These high relevance risk factors were identified in populations close to operating surface coal mine developments (Cortes-Ramirez, J.M., et. al., 2018).

- Mortality
 - Chronic diseases of the circulatory system (Talbot et al., 2015; Esch and Hendryx, 2011)
 - Cancer of the lung, colon, breast, prostate, and all combined cancers (Mueller et. al., 2015; Hendryx et. al., 2010)
- Morbidity
 - Congenital anomalies (Ahern et. al., 2011)
 - Cancer of the lung, colon, breast, prostate, and all combined cancers (Mueller et. al., 2015; Hendryx et. al., 2010)

¹ Small, D.M.S. et al., 2021; Gohlke, J.M., 2021; Hendryx, M., Zullig, K.J. and Luo, J., 2020; Aneja, V.P., et. al., 2017; Lamm, S.H. et al., 2013; Knuckles, T.L., et. al., 2013; Cordial, P., et. al., 2021; Ahern, M. et. al., 2011; Hendryx, M., 2009

² Harris, P., et. al., 2021; Riley, E., et. al., 2020; Hendryx, M., et. al., 2020; Williams, G. and Nikijuluw, R., 2020; Werner, A.K., et al., 2018; Sincovich, A., et. al., 2018; Selvey, L., 2014; Dalton, C.B., et. al., 2014; Cottle, D., 2013; Weng, Z., et al., 2012; Higginbotham, N., et. al., 2010; Franks, D.M., et. al., 2010; Connor, L., et. al., 2009; Evans, R., et. al., 2007

³ Hendryx, M., et. al., 2020; Li, Q., et. al., 2019; Hussain, R., et. al., 2018

⁴ Uggupta, S. and Singh, P.K., 2017; Hota, P. and Behera, B., 2015; Mishra, S.K., 2015; Singh, G., 2008

Air Quality Management in Alberta

As discussed above, given the potential for development of metallurgical coal mines in the SSR and the documented impacts to air quality and community health associated with fugitive dust and gas emissions from surface coal mine operations, a review of the air quality management framework and available monitoring data in Alberta and the SSR is provided.

In Alberta, air quality is managed through a patchwork of regional, provincial, and federal frameworks focusing on Criteria Air Contaminants (CACs), however, provincial guidelines are available for additional air toxicants such as metals and volatile organic compounds.

Regional management thresholds and triggers are prescribed for PM_{2.5}, NO₂ and ozone in the “*South Saskatchewan Region Air Quality Management Framework*” which is designed to maintain flexibility and proactively manage the cumulative effects of human activity on ambient air quality and surface water quality within the South Saskatchewan Region (Alberta Government, 2014). Under this management framework Alberta is required to monitor ambient air in the SSR. Figure 5 identifies the SSR air monitoring network, concentrated in urban centers, as of 2018 (the most recent available reporting year) (Thi, A. 2020).

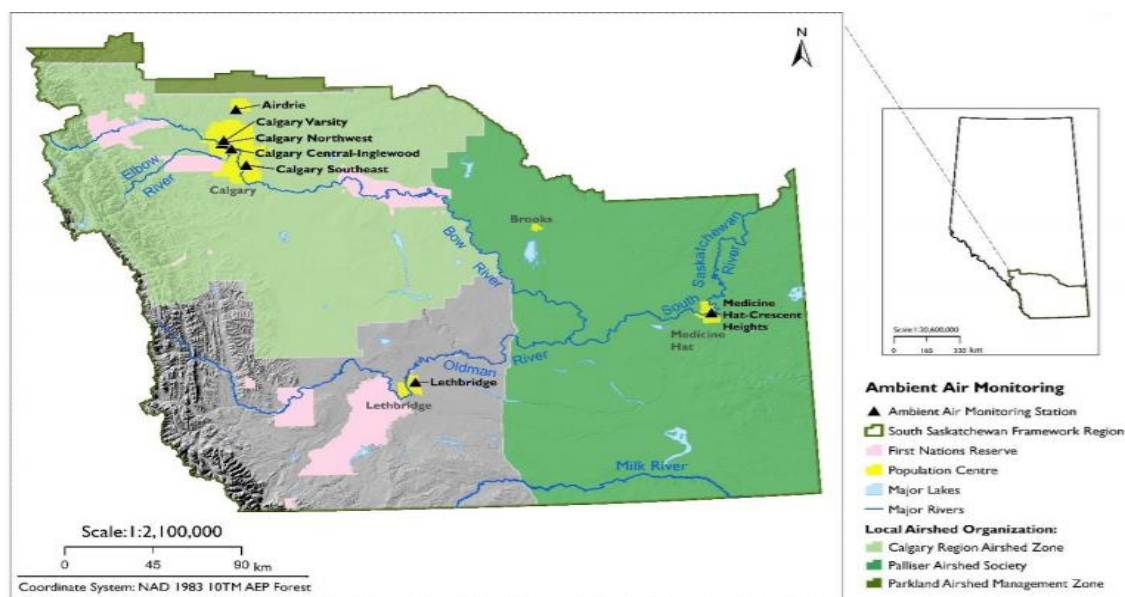


Figure 5. Locations of the seven ambient air monitoring stations in the South Saskatchewan Region. Adopted from Thi, A. 2020. 2018 Status of Air Quality, South Saskatchewan Region, Alberta. Government of Alberta, Ministry of Environment and Parks. ISBN 978-1-4601-4894-5. Available at: <https://open.alberta.ca/publications/status-of-air-quality-south-saskatchewan-region-alberta>.

Provincial objectives and guidelines are developed under the Alberta Environmental Protection and Enhancement Act (EPEA) to protect Alberta’s air quality as defined in the “*Alberta Ambient Air Quality Objectives and Guidelines Summary*”. Objectives are intended for application to air quality measurements in the ambient environment and are used to determine adequacy of facility design, establish stack heights and release conditions (for air contaminants) and assess compliance and performance of operating facilities. By comparison, guidelines are used for airshed planning, as general performance indicators and to assess local concerns (AEP, 2019).

Lastly, federal requirements are prescribed within the Air Quality Management System (AQMS) which is a collaborative approach by federal, provincial, and territorial governments to reduce the emissions and ambient concentrations of various pollutants of concern, specifically; PM_{2.5}, ground level ozone (O₃), NO₂, SO₂ and Volatile Organic Compounds (VOCs). Canadian Ambient Air Quality Standards (CAAQS) have been identified, as numerical values/ concentrations, for PM_{2.5}, O₃, NO₂, SO₂ (CCME, undated). Under the AQMS, provinces, including Alberta, are required to report on performance annually for identified air zones (Brown, C. 2019).

A summary of regional, provincial, and federal objectives, guidelines and standards for CACs is provided in Table 1. For context and comparison, World Health Organization (WHO) air quality guidelines designed to reduce the health impacts of air pollution have also been included in Table 1 (WHO, 2006; 2018).

Table 1. Summary of applicable regional, provincial, and federal air quality objectives, guidelines, and standards for the management of ambient air quality in Alberta.

		Regional (SSRP AQMF)		Provincial (AAAQO)	Federal (CAAQS)*	Global (WHO)
		Average	Upper Range	99 th percentile	Variable	Mean
TSP	Daily	---	---	100	---	---
	Annual	---	---	60	---	---
PM_{2.5} (ug/m³)	Hourly	---	---	80	---	---
	Daily		28	29	27	25
			19			
			10			
	Monthly	---	---	---	---	---
	Annual		10	---	8.8	10
			6.4			
			4.0			
PM10 (ug/m³)	Daily					50
	Annual					20
SO₂ (ug/m³)	Hourly	---	---	450	183	
	Daily	---	---	125	---	20
	Monthly	---	---	30	---	---
	Annual	---	---	20	13.08	---
NO₂ (ug/m³)	Hourly	---	---	300	112.83	200
	Daily	---	---	---	---	
	Monthly	---	---	---	---	
	Annual			45	31.97	40

*reported values (ppb) converted to ug/m³ = ppb x (molecular weight/molecular volume). Where molecular volume = 22.41 x (Temperature/273) x 1013/atmospheric pressure); T = 25C, P = 101.325 kpa.

Bold indicates lowest published guideline, objective, or standard

In addition to managing the quality of air, Alberta has implemented a system for assessing and managing risks to ecosystem health from acid deposition, the “*Alberta Acid Deposition Management Framework*”.

The management framework is designed to identify areas that are sensitive to acidifying emissions and potential issues from development at an early stage (Alberta Environment, 2008).

As described in the framework, assessments are undertaken by estimating the potential acid input (PAI) from wet and dry deposition (as measured or modelled) using provided equations (Alberta Government, 2011) and comparing to critical, target and monitoring loads defined by the province (Alberta Environment, 2008).

Implementation of the framework requires baseline data to define the receptor sensitivity. As shown in Figure 6(a), area-specific data is lacking in the SSR, including the Pekisko Heritage Rangelands. Acknowledging this gap, the Government of Alberta undertook modelling to predict acid sensitivity for areas lacking monitoring data (Alberta Government, 2011). Acid sensitivity is predicted to be low-medium in the SSR at a coarse resolution, as shown in Figure 6b.

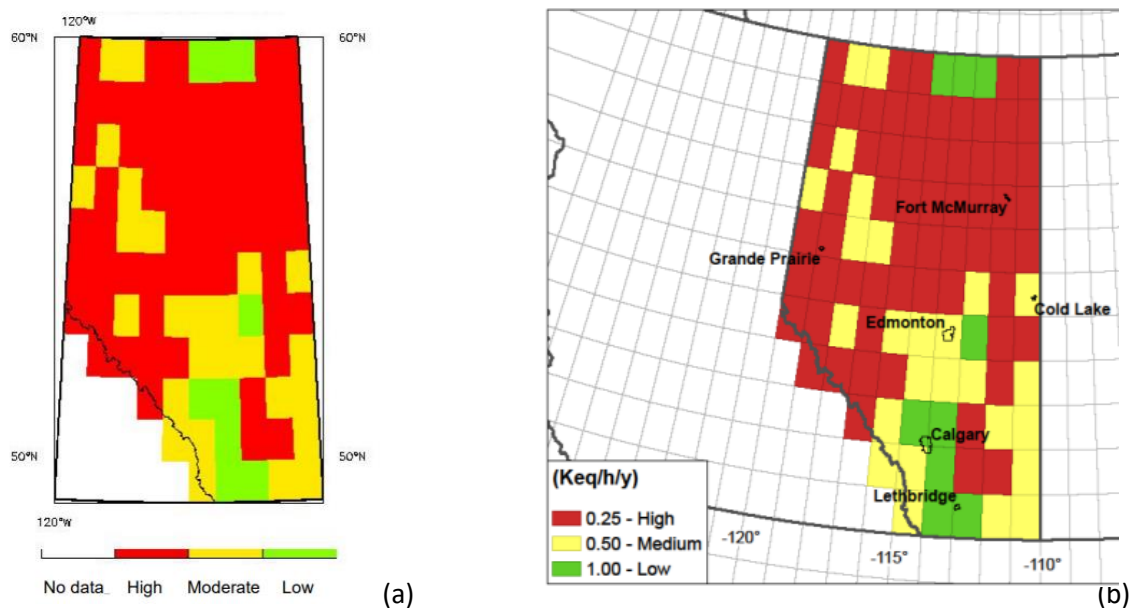


Figure 6. (a) Measured and reported acid sensitivity for grids in Alberta. Adopted from Figure 2 published in Alberta Environment. 2008. *Alberta Acid Deposition Management Framework*. (b) Predicted acid sensitivity in areas lacking monitoring data Adopted from Figure 8 published in Alberta Government. 2011. *2011 Acid Deposition Assessment for Alberta A Report of the Acid Deposition Assessment Group*.

Objectives and Goals

The objective of the proposed scope of work is to provide an independent assessment of potential air quality impacts and health risks from development of metallurgical coal mine leases in the Livingstone Range and Pekisko Heritage Rangelands within the Eastern slopes of the Rocky Mountains.

The goals of this study are provided below:

1. Create a cumulative mine scenario and inventory of potential air emission sources based on the planned development case (PDC) for metallurgical coal mining in the Southern Eastern Slopes and propose
2. Develop a surface coal mine air quality focused conceptual site model, including sources and types of air contaminants, transport and exposure pathways and receptors which may be exposed.
3. Predict concentrations and deposition of contaminants which may be released from the cumulative mine scenario using terrain and meteorology data within the study area to support the assessment of potential risks
4. Assess potential risks to residents (humans), livestock, and crop health from exposure to predicted air quality in the PDC.
5. Identify potential risk drivers to consider in the proposed development of coal leases in the study area

Methods

The following methods and assumptions were used to develop a cumulative mine scenario for a planned development case (PDC) to support air dispersion modelling and an assessment of impacts to air quality and potential health risks.

Cumulative Mine Scenario (Planned Development Case)

The 8 prospective metallurgical coal mines, listed below and shown in Figure 4 (adopted from Stelfox, B. and Donahue, B. 2021) were considered an accurate representation of the PDC for this report.

- Grassy Mountain
- Tent Mountain
- Elan South
- Isolation South
- Cabin Ridge
- Isola
- 4-Stack
- Chinook (Vicary)

The study reported here was designed to understand the cumulative air quality influences from the 8 potential surface coal mine projects. To date, Grassy Mountain Mine is the only proposed mining development that has undergone a regulatory application and review process that has resulted in publicly accessible environmental impact assessment information (CEAA, 2021).

The cumulative coal mine scenario and PDC within the study area was used to assess potential air quality impacts and health risks is presented below in Figure 7.

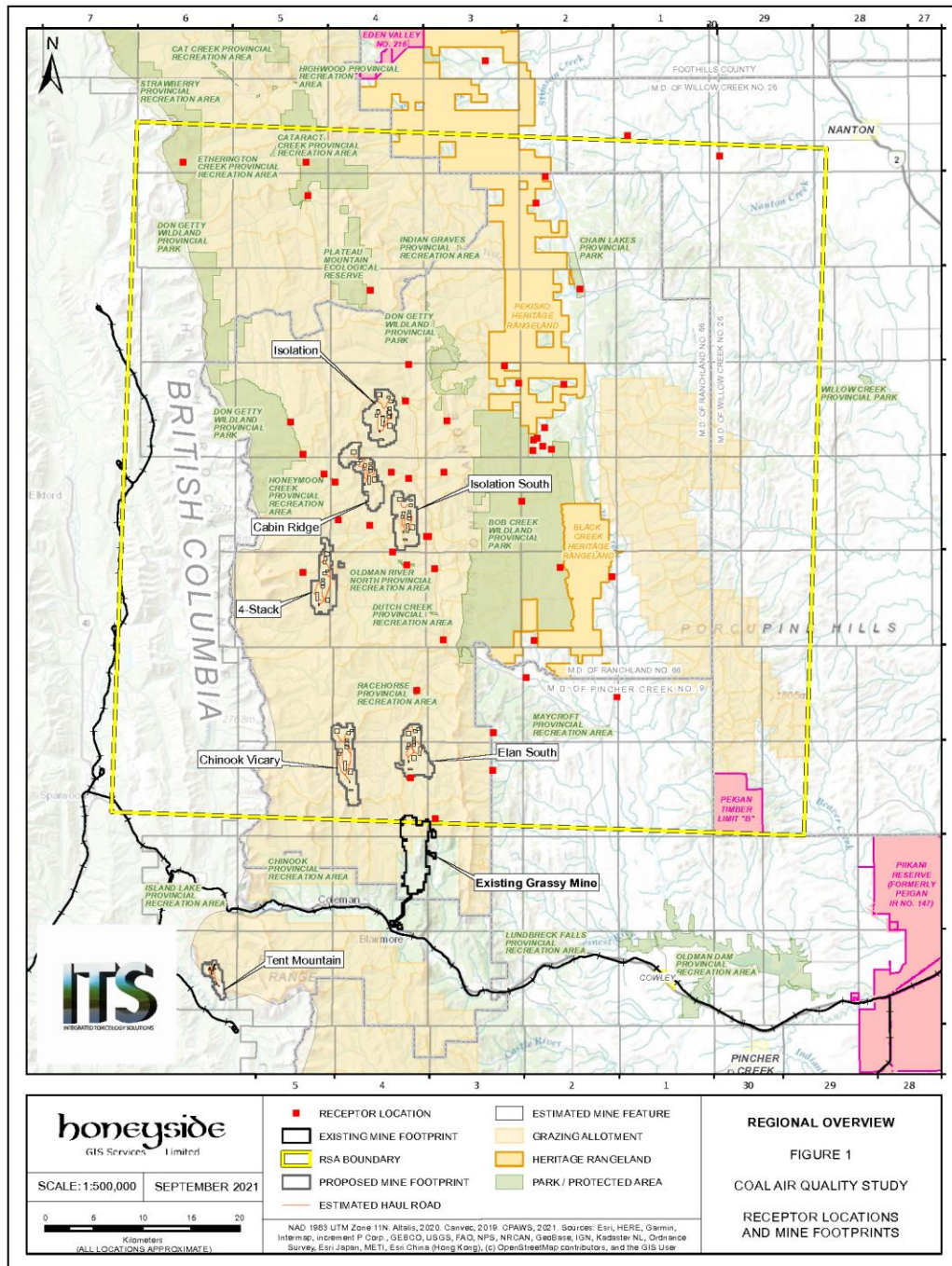


Figure 7. Cumulative coal mine scenario and planned development case for assessing air emissions in the study area.

The mine simulations developed to support the assessment of water quality and quantity impacts from the cumulative mining scenario, indicate that a planned development case or future scenario could result in the removal of 6 billion m³ of overburden and ore to produce ~ 700 million tonnes of coal within eight active mining operations over a 94 km² area over 50 years, as shown Table 2 adopted from Stelfox, B and Donahue, B. (2021).

Table 2: Projected cumulative area of disturbance for the Tent Mountain, Elan South, Isolations South, Cabin Ridge, Isola, 4-Stack and Chinook Vicary mines (Adopted from Stelfox, B. and Donahue, B., 2021)

Prospective Coal Project Name	Low Growth Scenario	Medium Growth Scenario	High Growth Scenario	Coal Project Lease Area (ha)	Cumulative Area of Disturbance (ha)	Proposed Lifespan yrs	Ave Annual Coal Production (tonne/yr)	Maximum Annual Coal Production (tonne/yr)	Cumulative Coal Production (MT)	Proven or Indicated Coal Resources (tonnes)
Grassy Mountain Coal Project		X	X	8,330	1,244	25	4,026,609	4,706,000	92,612,000	1,125,000,000
Tent Mountain Project		X	X	1,931	364	14	1,020,639	1,198,600	14,288,950	22,000,000
Elan South Coal Project			X	13,000	1,261	22	3,997,701	5,293,179	91,947,116	47,000,000
Isolation South Coal Project			X	6,239	1,278	21	5,528,137	6,000,000	127,147,151	112,000,000
Cabin Ridge Project Ltd			X	5,000	1,276	23	3,997,701	5,293,179	91,947,116	100,000,000
Isola Coal Project			X	4,832	1,354	25	3,997,701	5,293,179	91,947,116	100,000,000
4-Stack Coal Project			X	1,965	1,235	25	3,997,701	5,293,179	91,947,116	100,000,000
Chinook (Vicary) Coal Project			X	10,000	1,334	25	3,997,701	5,293,179	91,947,116	149,000,000
Totals				51,297	9,346		13,875,674	23,948,137	693,783,680	1,755,000,000

Mine footprints and Scaling Factors

Mine areas projected in Chernos, M. et. al. (2021) were provided by the authors to support the development of air emission sources on each of the 8 proposed mine sites. Air emission sources were scaled based on the details provided in the Grassy Mountain Mine application (Millennium EMS, 2016) using scaling factors derived from the reported disturbed area (Ha).

Each potential coal mining development was estimated based on the projected cumulative area of disturbance based on disturbed area for the other 7 potential mines reported in Table 2. Based on this, each mine is scaled to Grassy Mountain's area of disturbance of 1,244 ha and a scaling factor as assigned (Table 3).

The methods reported here assume reported disturbance are accurate and resemble that of actual disturbed areas if the mines were to be developed. The magnitude of air emissions is positively correlated with the disturbed area and any alterations in mine footprint would increase or decrease air emissions.

Table 3: Mine footprint scaling factors based on cumulative area of disturbance compared to the Grassy Mountain project

Project	Cumulative Area of Disturbance (ha)	Disturbance Area Scaling Factor
Grassy Mountain	1,244	1.00
Tent Mountain	364	0.29
Elan South	1,261	1.01
Isolation South	1,278	1.03
Cabin Ridge	1,276	1.03
Isola	1,354	1.09
4-Stack	1,235	0.99
Chinook (Vicary)	1,334	1.07

Developing proposed mine sites

The Grassy Mountain project air quality assessment used Year 19 of the mine's operations as the basis of air emissions estimate. The operation areas which contribute to air emissions modelled by Millenium EMS (2016) consist of the following:

- North and South Dump;
- Waste Strip Areas 1, 2, and 3;
- Coal Mine Areas 1 and 2;
- Drilling Areas 1, and 2;
- ROM Stockpile;
- Clean Stockpile;
- Reclamation Area;
- Rail Loadout; and
- Haul Roads.

Proposed mine layouts for each of the 7 potential mines were prepared based on mine footprint scaling factors identified in Table 3 for each of the identified air emission sources by operating. Haul roads were developed by manually connecting the operation areas as shown in Figure 8.

Air emissions were then estimated for from each operating area and associated equipment based on the generated mine layouts by modifying the Grassy Mountain project emission factors using scaling factors presented in Table 3. Except for the Grassy Mountain project, coordinates for these areas are compiled based on the created layouts for the potential mining projects. Coordinates for Grassy Mountain operation areas are estimated based on Grassy Mountain's Air Quality Assessment Figure A2-1 (Millennium EMS Solutions Ltd., 2016) after importing into Google Earth as an overlay.

To design the proposed mine areas several assumptions were required. These assumptions result in uncertainty in the subsequent air dispersion modelling and health risk assessments.

- Created layouts for each mine prepared based on Year 19 of the Grassy Mountain project is representative of the actual layout of the respective mines. Ore reserve and mine engineering factors were not considered.
- In applying created mine layouts based on Year 19 of the Grassy Mountain project (identified in the Grassy Mountain Air Quality Assessment as the year when reasonably worst case emissions is expected based on overburden removal volume and hauling road distance), the assumption is that this scenario represents the worst-year for air emissions for all potential mining projects being developed concurrently.
- Haul road placement for the respective mines is strictly based on the created layouts and does not consider feasibility of haul road design and construction.

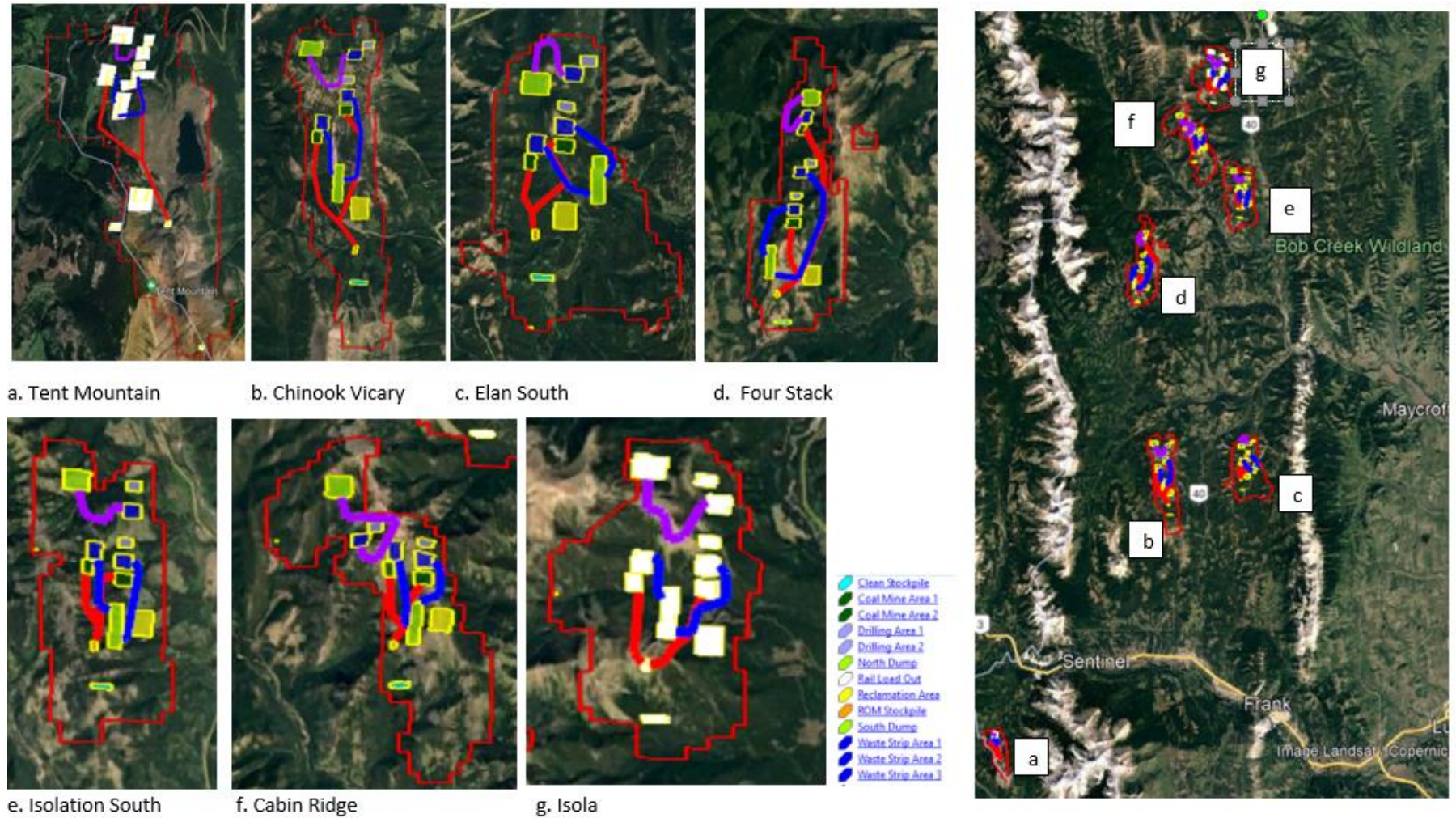


Figure 8. Generated mine sites for proposed coal mines based on cumulative disturbed area scaling factors applied to Grassy Mountain Mine development plans as reported in Millennium EMS (2016).

Conceptual Site Model

Review of the Grassy Mountain project application to generate the mine site air emission sources by operating area allowed for the identification of types of air contaminants which may be released from metallurgical coal mines. The potential sources of air contaminant releases were identified as follows in the various operating areas (Millennium EMS, 2016);

- Diesel fired equipment emissions,
- Ammonium nitrate and fuel oil for blasting operations, and
- Fugitive dust emissions.

Based on these primary air contaminant sources an air emission focussed conceptual site model (CSM) describing the types of contaminants released from each source and how these contaminants move in the environment and expose biological receptors.

The CSM described in Table 4 was developed by adopting the reported air emission sources in the Grassy Mountain Mine Project (Millennium EMS Solutions, 2016), linking potential sources to air contaminant fate and transport pathways, and integrating community concerns (shared by the Pekisko group) along with scientific information of health effects in exposed receptors.

The CSM presented in Table 4 was used to guide the air quality modelling and health risk assessment components.

Table 4. Conceptual Site Model (CSM) describing air emission sources, transport and exposure pathways, and receptors of concern related to surface coal mining, local infrastructure and Pekisko group concerns.

Activity	Sources	Emission type	Contaminants of Potential Concern COPCs)	Transport Pathway	Exposure Pathway (primary)	Exposure Pathway (secondary)	Receptor of Concern			
Surface Coal Mine (Mountain Top Removal Mining)	Coal Mine areas Drilling areas Dump areas Rail load areas Reclamation areas Stockpile areas Waste strip areas*	Diesel Combustion Blasting*	SO2*, NOx*, PM2.5, PM10, TSP	Air	Inhalation	---	Human			
			Trace elements and heavy metals (Al, As, Ba, Cd, Cr, Hg, Mo, Mn, Ni, Pb, Sb, Se, Tl, U, V, Zn)				Livestock			
			Acid compounds (SO2, SO4-2, NO2, NO3-, HNO2, HNO3)	Deposition	Direct	---	Ingestion	Vegetation		
			Base Cations (K+, Na+, Ca2+,Mg2+)		---			Water		
			Trace elements and heavy metals (Al, As, Ba, Cd, Cr, Hg, Mo, Mn, Ni, Pb, Sb, Se, Tl, U, V, Zn)		---			Soil		
	Coal Mine areas Drilling areas Dump areas Rail load areas Reclamation areas Stockpile areas Waste strip areas*	Fugitive dust	PM2.5, PM10, TSP including bound; -Base Cations (K+, Na+,Ca2+,Mg2+) -Trace elements and heavy metals (Al, As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mo, Mn, Ni, Pb, Sb, Se, Tl, U, V, Zn)	Air	Inhalation	---	Human			
				Deposition	Direct		---	Livestock		
						Vegetation				
						Water				
						Soil				
Coal Mine areas Drilling areas Dump areas Rail load areas Reclamation areas Stockpile areas Waste strip areas*	Fugitive dust	PM2.5, PM10, TSP including bound; -Base Cations (K+, Na+,Ca2+,Mg2+) -Trace elements and heavy metals (Al, As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mo, Mn, Ni, Pb, Sb, Se, Tl, U, V, Zn)	Deposition	Direct	---	Human				
						Livestock				
						Vegetation				
						Water				
			Coal Mine areas Drilling areas Dump areas Rail load areas Reclamation areas Stockpile areas Waste strip areas*	Fugitive dust	PM2.5, PM10, TSP including bound; -Base Cations (K+, Na+,Ca2+,Mg2+) -Trace elements and heavy metals (Al, As, Ba, Be, Cd, Co, Cr, Cu, Hg, Mo, Mn, Ni, Pb, Sb, Se, Tl, U, V, Zn)	Deposition	Direct	---	Soil	
Human										
Livestock										
Vegetation										
Water										
Local Infrastructure	Highways	Road emissions Area emissions	See diesel combustion	Air	Inhalation	---	Human			
				Deposition	Direct		---	Livestock		
	Communities		See fugitive dust			Deposition		Direct	---	Vegetation
										Water
										Soil
				Human						
Communities	See fugitive dust	Deposition	Direct	---	Livestock					
					Human					
Communities	See fugitive dust	Deposition	Direct	---	Livestock					
					Human					
Communities	See fugitive dust	Deposition	Direct	---	Livestock					
					Human					

Air Dispersion Modelling

Dispersion modelling was performed utilizing the CALPUFF V7 (Lakes, 2021) in accordance with the requirements outlined within the AEP Air Quality Modelling Guideline (AQMG) (AEP, 2013).

The CALPUFF model was selected for this project to accommodate different modelling parameters required for all source types. CALPUFF can be applied to a wide variety of scenarios including far-field impacts which cannot be modeled with traditional plume models (e.g., AERMOD). Its three-dimensionally varying meteorological field makes it useful for regions with very complex terrain or non-steady-state conditions.

The latest version of the CALPUFF dispersion model (V7.2.1) was used in this assessment. The CALPUFF dispersion model is an advanced, non-steady-state meteorological and integrated Lagrangian puff modeling system developed by scientists at Exponent, Inc. and distributed by the Atmospheric Studies Group at TRC Solutions.

The CALPUFF dispersion model options adhere to the default options and recommended deviations as presented in Appendix D of the AEP AQMG (AEP, 2013) unless otherwise stated. The CALPUFF model options used in this assessment are presented in Appendix A Table A.1.

Meteorology

One year of meteorological data was extracted from the AEP Fifth Generation NCAR/Penn State Mesoscale Model V3.5 (MM5) for the year 2006 (AEP, 2019). The three-dimensional (3D) wind fields used in the CALPUFF dispersion model were created using the CALMET (Version 6.5.0) model, which was developed specifically for use with the CALPUFF dispersion model.

The MM5 was used to produce modelled meteorological data, as there are no publicly available observed surface or upper air meteorological data available for the modelling domain. Based on the MM5 data, the prevailing surface wind direction in this region is from the west southwest with an average wind speed of 4.09 m/s. Additionally, most of the winds that occur in the modelling domain are less than 10 m/s, and those that are over 10 m/s occur approximately 1% of the time.

The wind class frequency and distribution and a wind rose describing wind speed and direction are provided over the modelled year (2006) in the study in Figure 9 and Figure 10. Each of these variables provides important context for interpreting air dispersion modelling results and verifying that model conditions are accurate representations of the study area as experienced by local residents.

The most common stability class was reported as D on the Pasquill scale which indicates neutral conditions with moderate to slight solar radiation and thin cloud cover/ overcast conditions at night (Turner, D.B. 2020).

The average windspeed from the available MM5 data was 16.92 km/hr with winds predominantly out of the WSW direction.

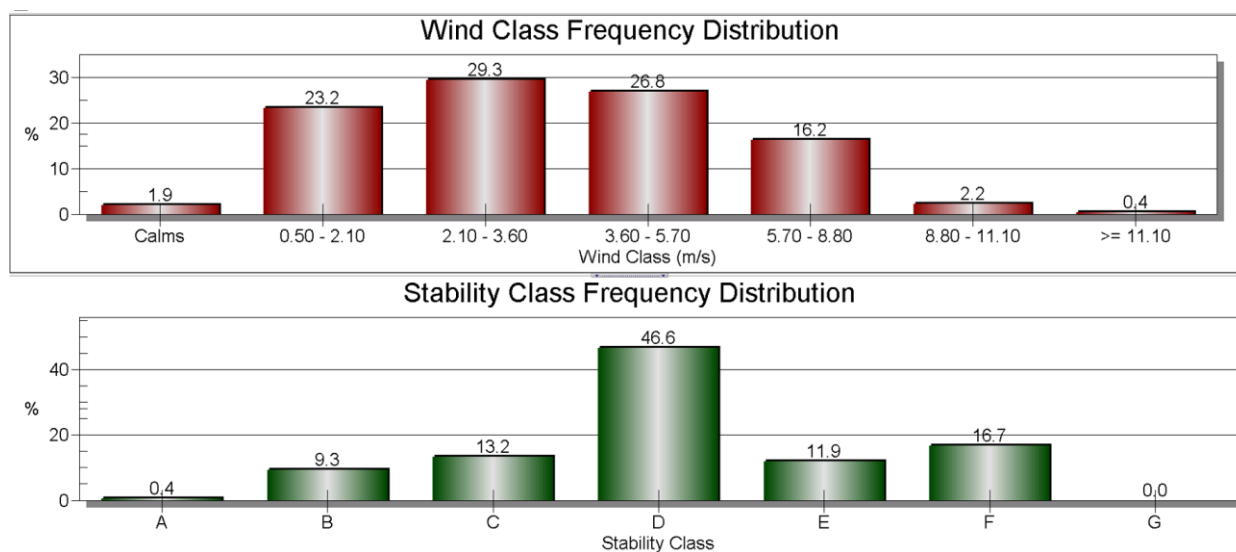


Figure 9. Wind and stability class frequency distribution for the modelling year (2006).

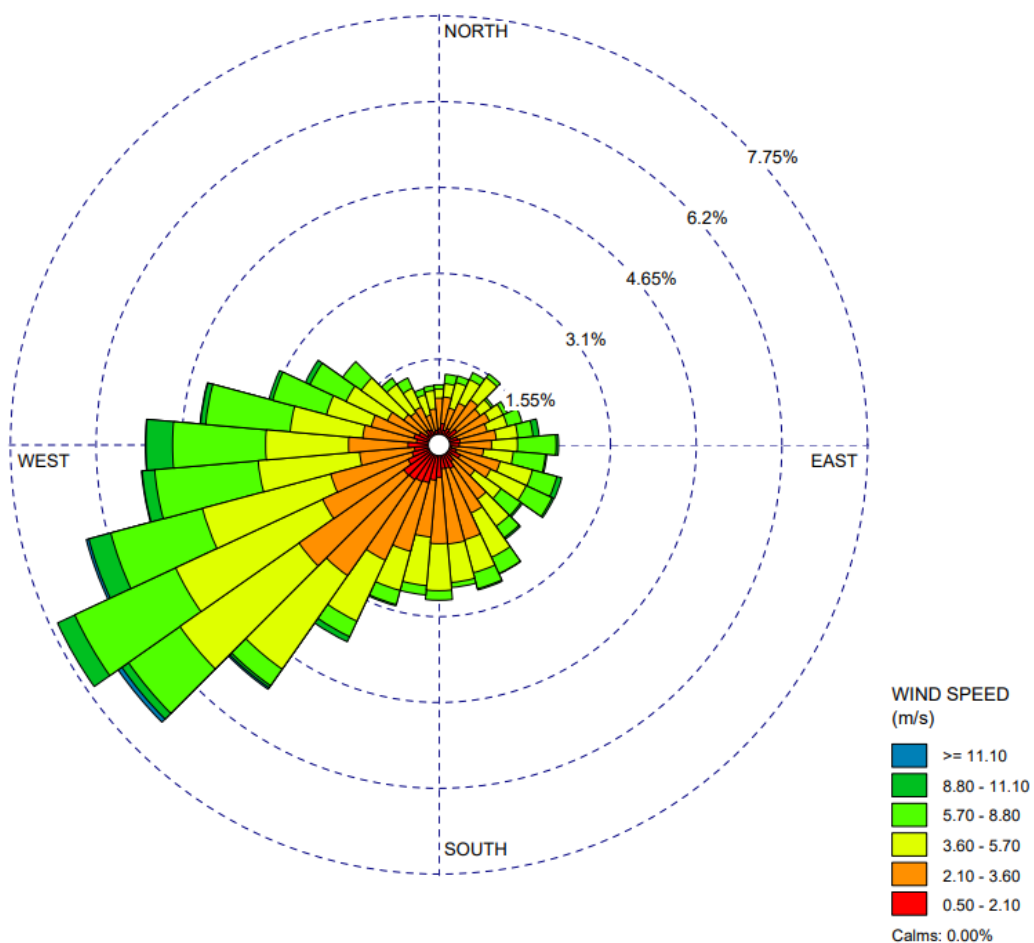


Figure 10. Annual (2006) wind rose generated from the AEP Fifth Generation NCAR/Penn State Mesoscale Model V3.5 (MM5) data describing frequency of wind speed and direction used in air dispersion modelling for the coal mine PDC.

Terrain

Canadian Digital Elevation Data at scale of 1:50 K and resolution of 15-min were extracted from GeoGratis Canada and processed by Geophysical Processor for the CALPUFF dispersion model (NRC, 2019). The domain used for this assessment incorporates topographic data from map tiles identified as 082G, 082H, 082I and 082J and characteristics are provided in Appendix A Table A.2.

Receptor Grid

The receptor grids in this assessment were developed with a 20 meters receptor spacing within a 70 km by 70 km modelling domain. Sensitive points such as residences, shown in Table A.3, were also added as discrete receptors. A total of 5,092 receptors were used in CALPUFF for the modelling domain.

Source emission Estimates – Grassy Mountain mine

Source emissions factors for this study were estimated from emission factors compiled by Millennium EMS Solutions Ltd. for the Grassy Mountain Coal Project Air Quality Assessment (Millennium EMS Solutions Ltd., 2016). Subsequent submissions from Benga Mining Limited to the Joint Review Panel in the form of additional information response package addenda were also consulted for emission estimate methodology and estimated figure updates.

Diesel fuel combustion emission factors estimated for Grassy Mountain project (k per day), were adopted from Table 4.2-3 (Millennium EMS Solutions, 2016), as presented in Table B.1 in Appendix B. These estimates were adopted for this study and allocated to the Grassy Mountain mine operation areas presented in Table B.2 in Appendix B.

Similarly, fugitive dust emissions estimated for Grassy Mountain project (kg/d), with the exception of PM_{2.5}, were adopted from Air Quality Assessment (Millennium EMS Solutions, 2016) Table 4.2-4 and is presented in Table B.3 in Appendix B. PM_{2.5} emissions were taken from Table ECCC12-2 CEAR #70 Addendum 6. The updated PM_{2.5} emissions reflected a 50% dust reduction with mitigation measures applied, rather than the 80% reduction committed to by Benga in the Grassy Mountain project application (296 kg/day total). No PM₁₀ and TSP emissions were included in this addendum so emissions were from Table 4.2-4 of the Air Quality Assessment. These estimates were likely an underestimation since fugitive dust consists of predominantly coarser particulate matters (i.e. PM₁₀ and TSP). No adjustments were made to these estimates as the study methodology required the use of Grassy Mountain emission estimates and the corresponding modelling results for initial validation. Emission estimates in Table B.3 were adopted for this study and allocated to the Grassy Mountain mine operation are presented in Table B.4.

Source emission Estimates – Proposed Mines (7)

Based on the Grassy Mountain emission estimates allocated to the operation areas (Table 4 and Table 5), emission intensities for each emission type and operation areas were generated by converting the emissions from kilogram per day into gram per second, then presented in standard units for CALPUFF input:

- For road sources (i.e. emissions from haul roads), emissions were divided by the length of the haul road in metres, resulting in emission intensities in g/s/m,
- For areas sources (i.e. emissions from operation areas other than haul roads), emissions were divided by the operation areas in areas metres, resulting in emission intensities in g/s/m²,
- For volume sources (blasting activities) were presented in g/s.

Emission intensities derived for Grassy Mountain were scaled to other potential mine developments for volume sources based on Mine Footprint Scaling as discussed in Section 2. areas source emission intensities were not scaled further since operation areas footprints were already scaled and these intensities were expressed per unit areas and length. Total road source emissions were adopted based on estimates from Grassy Mountain air quality assessment and simply divided by projected haul road lengths to obtain the intensities (i.e. not scaled). There is substantial uncertainty associated with each created mine layout and the locations of operation areas and haul road placement. The haul road distances for each mine used in this study were considered arbitrary.

Due to limitations of the number of emission sources accepted by the CALPUFF model, waste stripping areas sources for PM_{2.5} were consolidated into a single area (as opposed to three) for each mine with three times the emission (i.e. total emission remains the same). All other sources were considered individually in the CALPUFF modelling conducted.

Diesel combustion and fugitive dust emission intensities were derived using the same methodology as outlined above.

Total emissions for each mine in kilograms per day were summarized Table 5. Note that SO₂ and NO_x emissions for Grassy Mountain were higher than those summarized in Table A.2. This is the result of blasting emissions being considered twice for blasting sources, discussed in Section 5.1.

Detailed emission intensities calculated for each areas, road, and volume source at the 7 proposed mines were included in Appendix C.

Table 5: Total projected emissions for all potential mining developments in kilograms per day

	SO ₂ (kg/d)	NO _x (kg/d)	PM _{2.5} (kg/d)	PM ₁₀ (kg/d)	TSP (kg/d)
4 Stack	24.6	3,101	707	2,832	10,928
Cabin Ridge	25.2	3,176	709	2,840	10,950
Chinook Vicary	26.2	3,282	711	2,853	10,982
Elan South	25.0	3,149	708	2,837	10,942
Isola	26.5	3,318	712	2,857	10,992
Isolation South	25.3	3,180	709	2,841	10,951
Tent Mountain	10.1	1,511	667	2,644	10,458
Grassy Mountain	24.7	3,118	707	2,834	10,933
Total	188	23,833	5,630	22,538	87,136

To develop the source emission profile for the PDC several assumptions were required. These assumptions may result in uncertainty in the subsequent air dispersion modelling and health risk assessments which rely on predicted air quality concentrations.

- All emission sources were distributed evenly across sources and uniform emission intensities were assumed across operation areas performing the same activities (i.e. Coaling Mining areas 1 have the same emission intensity as Coal Mining areas 2).
- Total emissions from haul roads (combustion and fugitive dust) were approximately the same for all potential mining developments.

- All potential mining developments will utilize Tier 4 compliance mine fleet (i.e. basis of mine fleet emissions used in Grassy Mountain Air Quality Assessment).
- All potential mining developments were assumed to achieve 50-80% dust for PM₁₀ and TSP, respectively.
 - o This assumption is very optimistic as a reliable source of water is required for regular dust suppression through water application. It is also not known what other dust control and mitigation measures will be exercised by each mine and how dust reduction will be monitored and measured.

Regional Emission Sources

Following the methodology outlined in Grassy Mountain Air Quality Assessment (Millennium EMS Solutions, 2016) Appendix A, no other regional industrial emissions were included in this study. Emissions from Highway 3 and the four communities (Blairmore, Coleman, Bellevue, and Frank) were included in this study which were adopted from Section A9 of the Air Quality Assessment. Coordinates for these regional sources were estimated on Google Earth.

Model Validation

Based on air emission estimates adopted from Grassy Mountain Air Quality Assessment (Millennium EMS Solutions, 2016) and subsequently allocated to the Grassy Mountain mine operation areas as presented in Table B.1, air dispersion modelling was conducted in CALPUFF. This preliminary modelling was conducted with only emissions from the Grassy Mountain project as a validation to ensure that the CALPUFF input parameters and emission estimates used can produce results that were in general alignment with those presented by Benga for the Grassy Mountain project. This quality assurance step ensures that air dispersion modelling for cumulative effects assessments for all potential mining projects is generally representative of the potential air quality impacts that one would expect should all mine developments were to proceed.

Predictions of ambient concentrations for SO₂, NO₂, and PM_{2.5} from the initial validation modelling compared to those presented by Benga for the Grassy Mountain project were provided in Appendix D.

With the exception of PM_{2.5}, Grassy Mountain air quality predictions were taken from Grassy Mountain Air Quality Assessment (Millennium EMS Solutions, 2016). PM_{2.5} predictions were taken from CEAR #89 Table ECCC-R2-5-1 Supplemental Information Request (October 2018) which reflect 50% dust reduction efficiency, as compared to 80% dust reduction efficiency initially considered in the project air quality assessment.

Modelling results presented in Table D.2 reflect different methods for estimating NO₂ emissions. This study did not apply the ozone limiting method as ozone was not identified as a COPC, whereas the Grassy Mountain Mine application accounted for reduced NO₂ due to losses during formation of ozone.

Predicted Ground Level Concentrations and Deposition

The CALPUFF model output provides and hourly predicted concentration or deposition across the receptor grid, at the Maximum Point of Impingement (MPOI), and at discrete receptor locations. This data can be used to calculate various statistical representations of the data (such as maximum, 99th and 98th percentile and average concentrations) over daily (24 hours), monthly (760 hours) and annual (8760 hours) averaging periods.

Due to time constraints the model was ran for 8760 hours or one year and data is not available to estimate annual averages of multiple years (as required by federal and regional guidance).

The predicted ground level concentrations (GLCs) at the MPOI and discrete receptor locations can then be compared to air quality standards, guidelines and objectives or used to support exposure estimates in the multi-media risk model, as described below.

Air Quality Assessment

Potential impacts to air quality from the cumulative mining under the PDC were assessed for gases and *particulate* matter as well as particulate associated heavy metals and PAHs by comparing predicted concentrations (99th percentile for hourly and averages for annual) a over various averaging periods to air quality standards, objectives, and guidelines (herein referred to as thresholds) published for the protection of environmental and human health. In addition to thresholds identified in Table 1 the following AAAQOs (AEP, 2019) were used to assess risks from exposure to particulate bound metals and PAHs, as described in the exposure assessment. The AAAQOs were presented as ug/m³ for available averaging periods and protection endpoint is indicated.

- Arsenic
 - 0.1 (hourly; human health - respiratory effects)
 - 0.01 (annual; human health - carcinogenicity)
- Chromium
 - 1 (hourly; not specified)
- Lead
 - 1.5 (hourly; not specified)
- Nickel
 - 0.1 (hourly; not specified)
 - 0.01 (annual; not specified)
- Benzo(a)pyrene
 - 0.0003 (annual; human health – chronic effects and carcinogenicity)
- Naphthalene
 - 3 (annual; unspecified health effects)

Deteriorated air quality was identified if the predicted concentration at the maximum point of impingement (MPOI) or at a discrete receptor exceeded the prescribed value for that air contaminant.

Background air quality data for gases and particulate matter was not available in the study were and contributions from air contaminants present under the current state of development were assumed to be negligible.

Applicable objectives, guidelines, and standards were identified on isopleths (visual representations of predicted concentrations and deposition of air contaminants) in the Results section and associated appendices as an indication of thresholds which may be impacted from the cumulative coal mining scenario under the PDC.

Assessing Impacts to Terrestrial Ecosystems from Acid Deposition

For acidifying emissions to result in negative long-term impacts to the terrestrial ecosystem, the rate of acidifying emissions needs to exceed the ‘critical load’ of the receiving soil. The soils’ critical load of acidity is defined as the highest level of deposition that will not lead to long-term, harmful changes to a receptor (GoA 2014). At the critical load, the physical and chemical properties of the receiving soil were expected undergo chemical changes. These chemical changes most commonly include a decline in pH and the mobilization of metals bound to soil mineral particles that affect nutrient availability and/or toxicity to native plants. The mobilization of these elements also contributes to the eutrophication and acidification of waterbodies within the watersheds of the receiving soils whose critical loads have been surpassed.

The indirect consequences of these changes include impacts to terrestrial ecosystem resilience, health, biodiversity and, potentially, the forage quality for grazing wildlife and livestock.

Geological Setting and Surficial Materials

The surficial geology of the regional study was characterized by the front ranges of the Rocky Mountains, foothills, and western grassland plains of southwestern Alberta. The surficial deposits include exposed bedrock in the mountains, with colluvial and till deposits overlying bedrock in the foothills and surrounding plains. Fluvial and Glaciofluvial deposits occur in river channels and valleys, with organic deposits occurring in wetlands. The soils in the study were developed on a combination of the exposed geological formations in the mountains and foothills and from Cordilleran/Laurentide ice sheet deposits in the foothills and surrounding plains (AGS, 2021).

Due to these predominantly locally derived parent materials, the mineralogy of the surface bedrock geology has a strong influence on the sensitivity of the soils of the study were to acidification. The generalized bedrock geology of the region is presented in Figure 11.

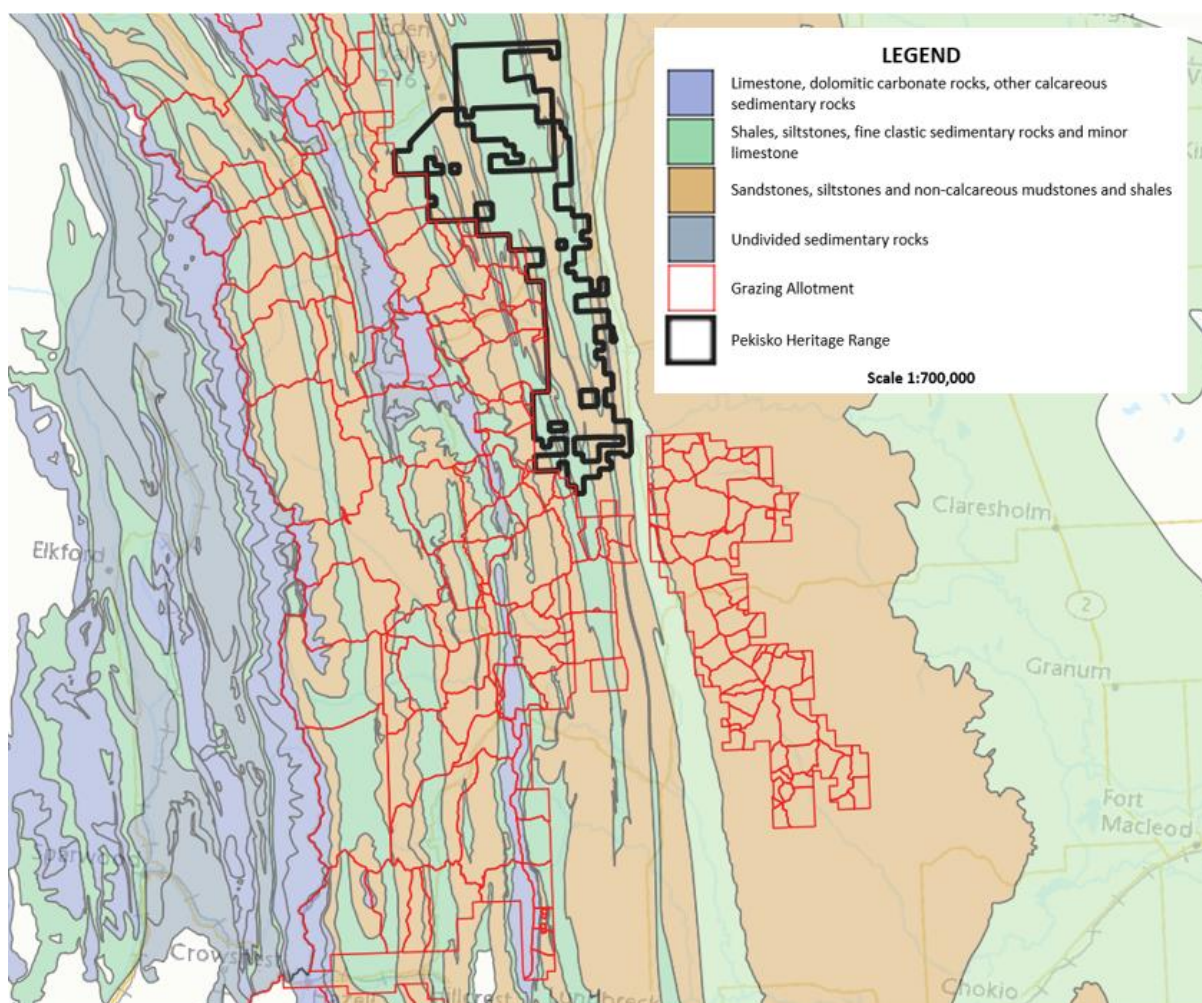


Figure 11. Geological Setting of the SW Alberta Grazing Allotments and the Pekisko Heritage Range

The foothills and plains in the eastern portion of the study area consist of the Porcupine Hills and Willow Creek Formations, overlain by quaternary glacial deposits. The Porcupine Hills Formation is composed primarily of sandstone with siltstones and mudstones. The mudstones were characterized by well-developed paleosols and caliche nodules, and the sandstones were cross-bedded and cemented with calcite. The Milk River Formation is a sandstone-dominated unit deposited in near-shore to coastal environments during the Late Cretaceous. The Smoky Group is represented by marine silty shale with ironstone and bentonite streaks. Sandstone occurs at the base and is transitional to the Dunvegan Formation.

The foothills include a thin exposure of the Bearpaw, Blood Reserve and St. Mary River Formations, with the Belly River Group, Milk River Formations complexed with the Alberta and Smoky Groups in the front ranges of the Rocky Mountains. The western half of the study area is dominated by a complex of the Blairmore Group, Mississippian Strata, the Fernie Formation and Kootenay Group.

The Blairmore Group includes the conglomerate and quartzose sandstones at the base, and grades to sandstone, siltstone, mudstone, and limestone in the overlying formations.

The Beaver Mines Formation in the upper part of the group also include minor beds of bentonite and tuff. The Kootenay Group, originally called the Kootenay Formation, is a geologic unit of latest Jurassic to earliest Cretaceous age. It includes deposits of economically beneficial coal.

The Fernie Formation is composed primarily of brown and dark gray to black shales. Sandstone and limestone, including cherty limestone, occur locally in the lower parts of the formation; siltstone, sandstone, coquinas and limestone interbeds can occur in the centre; sandstone and siltstone can be present in the upper parts. The Mississippian is a subperiod in the geologic timescale. It is the earlier/lower of two subperiods of the Carboniferous period lasting from roughly 360 to 323 million years ago. The cratons were surrounded by extensive delta systems and lagoons, and carbonate sedimentation on the surrounding continental platforms, covered by shallow seas. In the study area, this interval consists primarily of marine limestones (AGS 2021).

Derivation of screening-level critical loads

As a screening-level indication of soil sensitivity to acidifying emissions, the dominant mineralogy of the geological units identified in the study area were classified according to the globally ubiquitous Skokloster Classification of critical loads (Table 6).

Table 6. Mineralogical Classification and Critical Loads for Soils (0-0.5 m) According to the Skokloster Classification.

Class	Dominant Weatherable Minerals	Critical Load ($\text{keq H}^+ \text{ha}^{-1} \text{yr}^{-1}$)
1	Quartz, rutile, anatase, kaolinite, gibbsite, orthoclase	<0.2
2	Muscovite, plagioclase, illite, montmorillonite, vermiculite	0.2 – 0.5
3	Amphibole, chlorite, biotite, epidote, glaucophane	0.5 – 1.0
4	Olivine, garnets, pyroxenes, epidote	1.0 – 2.0
5	Carbonates	>2.0

Note: From Turchenek and Abboud (2001) after Nilsson and Grenfeldt (1988) and Sverdrup and Warfvinge (1988)

Of the mineralogy expected in the study area based on the bedrock geology, the sensitivity of the soils to acidification ranges from not sensitive at all (carbonates of the Mississippian, mid to lower Fernie, and upper Blairmore; Class 5), to potentially sensitive (lower Blairmore [Cadomin], upper Fernie, lower Smoky, and Porcupine Hills (Class 1 to 3).

Determining Sensitivity of Soils to Acidifying Emissions

At a provincial scale, the sensitivity of soils to acidifying emissions were generally understood (Figure 12). Due to the wide range of sensitivities of minerals at the surface to acid deposition in the study area, a higher-resolution screening was completed using the AGRASID 4.0 soil information (ASIC 2016), the surficial geology mapping (AGS 2021) of the “Green area” in mountainous portions of the region that were outside the AGRASID 4.0 mapped area, and neighbouring British Columbia Soil Survey Reports (Biophysical Resources of the East Kootenay Area: Soils, BC MOE 1990). The methodology for linking soil classification, physical and chemical properties to sensitivity to acidifying emissions was based on Turchenek and Abboud (2001), *Site Specific Critical Loads of Acid Deposition on soils in the Provost-Esther Area, Alberta*. In this work, the authors made reliable qualitative inferences of the relative acid deposition sensitivities

of Alberta soils on grazing and forested land uses in a parkland/prairie biogeoclimatic setting (Table 7 and Table 8).

Table 7. Allocation to Skokloster Material Class Based on Particle Size Class

Particle size class	Soil material class
Sand, loamy sand, sandy loam, (sandy) silt loam	Class 2
Clay loam, sandy clay loam, silt loam	Class 3
Clay, silty clay, sandy clay	Class 4

Note: From Turchenek and Abboud (2001) after Hornung et al. (1995).

Table 8. Factors Causing a Decrease or Increase in Critical Loads of Acidity for Soils

Factor	More Sensitive (Lower Critical Load)	Less Sensitive (Higher Critical Load)
Precipitation	High rain/snowfall	Low rain/snowfall
Vegetation	Coniferous Forest	Deciduous Forest
Elevation slope	High slope gradients/elevation	Low slope gradients/elevation
Soil Texture	See Table 7	See Table 7
Soil Drainage	Free (Rapid to Moderately Well)	Impeded (Imperfect to Very Poor)
Soil/till depth	Shallow	Thick
Sulphate adsorption capacity	Low	High
Base cation deposition	Low	High

Note: From Turchenek and Abboud (2001) After Nilsson and Grenfeldt (1988) and Hornung et al. (1995)

To adapt these principles to the soil characteristics of the study area, the most recent version of the soil layer (horizons) file and the soil names file of AGRASID 4.0 was downloaded from the Alberta Agriculture website (GoA 2021). The soil names and horizons (upper solum [Organic, Litter, A, and B horizons]) for the three soil correlation areas (SCAs) within the study area were extracted (SCAs 16, 5, and 8). The soil names were given ratings Low, Moderate, or High sensitivity by giving each soil name a score of 0 (Low) to 2 (High) on the following four factors: parent material texture, soil salinity (base cation %), soil drainage, and soil calcareousness (correlated to buffering capacity of the soil) The total scores for each soil series were then grouped Low sensitivity (0 to 4), Moderate sensitivity (5 to 6) and High sensitivity (7 to 8).

Next, each of the soil layers (Organics, Litter, A and B horizons) for the soil series in SCAs 16, 5, and 8 were rated using a similar strategy for the following characteristics: Cation Exchange Capacity, Electrical Conductivity, pH, and soil texture, and the total scores for each soil horizon were classified according to Low, Moderate and High sensitivity. The most sensitive rating of the horizons within each soil series were retained.

The next step was to combine the sensitivity classifications for each series between the names file and the layers (horizons) file. Where the two ratings differed, a complexed rating (i.e. Low-Moderate, Moderate-High) was assigned. There were a few instances where one rating was “Low” and the other was “High”. In these few instances, a rating of “Moderate” was assigned.

A similar concept was applied to the soil map units in neighbouring British Columbia that cover the western portion of the region. An assessment of the Alberta surficial geology map units were made based on inferred correlation of surficial deposits to associated soil series within the AGRASID 4.0 mapped area.

Appendix E provides the resulting relative risk ratings for the soil series that occur in the three SCAs within and closest to the study area, the geographically relevant soil map units in British Columbia on the west, and the surficial geology units within Alberta in between the two soil mapping extents.

The final step was to align the rating categories to the Skokloster Classifications divisions for critical loads and the sensitivity grid classifications used by the Acid Deposition Monitoring Framework (GoA 2014). This step factored in the bedrock geology of the study area to make a reasonable prediction of the mineralogy of the soil types based on the physical and chemical properties of the soil classifications, horizon data, and their depositional environments. Although this approach should not be considered equivalent to detailed sampling and modelling of critical loads on a site-specific basis, the general concepts were applicable and they offer a screening level assessment of relative risk of acidification of soils. In the absence of field-level soil chemistry and physical properties sampling, this approach is appropriate due to the wide range in mineralogical characteristics of surficial materials expected in the study area from the discussion of the regional geology. By assigning relative risk ratings to a quantified critical load range (i.e., Skokloster Classification), risks of environmental impact at a study area scale can be forecasted and linked to CALPUFF model outputs of acidifying emissions over the air dispersion/deposition modelling domain.

Assessment of Environmental Effects to Soils due to Acid Deposition

The air dispersion modelling outputs for NO_x , SO_x and Base Cation concentrations were entered into GIS and the Total PAI ($\text{PAI}_{\text{Total}}$) was calculated by combining the output layers via the formulae presented in the Air Quality Management in Alberta section (GoA 2014). The resultant PAIs model was then interpolated for isopleths that align with Alberta, critical, target, and monitoring directives:

Critical Load – the highest load that will not lead to long-term, harmful changes to a receptor.

Trigger levels:

- 0.25 keq H^+ ha^{-1} yr^{-1} for sensitive grid cells.
- 0.50 keq H^+ ha^{-1} yr^{-1} for moderately grid cells.
- 1.00 keq H^+ ha^{-1} yr^{-1} for grid cells of low sensitivity.

Target load – the level of deposition that consider load and is practically and politically achievable.

- 0.22 keq H^+ ha^{-1} yr^{-1} for sensitive grid cells.
- 0.45 keq H^+ ha^{-1} yr^{-1} for moderately grid cells.
- 0.90 keq H^+ ha^{-1} yr^{-1} for grid cells of low sensitivity.

Monitoring load – the level of deposition predicted or estimated by a dispersion model and deposition model that trigger monitoring and/or research.

- 0.17 keq H^+ ha^{-1} yr^{-1} for sensitive grid cells.
- 0.35 keq H^+ ha^{-1} yr^{-1} for moderately grid cells.
- 0.70 keq H^+ ha^{-1} yr^{-1} for grid cells of low sensitivity.

Through the application of this approach, the following critical load ranges were assigned to the relative sensitivity to acidification ratings as shown on Table 9, and Figure 12.

These isopleths were overlain on the soil sensitivity to acidification map (converted to grid cell sensitivity) and exceedances were documented and assessed (see Results section).

Table 9. Critical Load Ranges for Soil Sensitivity to Acidification Relative Risk Ratings and Correlation to Grid Cell Sensitivity Ratings

Relative Risk Rating	Critical Load Range (keq H ⁺ ha ⁻¹ yr ⁻¹)	Grid Cell Sensitivity Rating
High	<0.2	High Sensitivity
Moderate-High	0.2-0.5	Moderate Sensitivity
Moderate	0.5-1.0	Moderate Sensitivity
Low-Moderate	1.0-2.0	Low Sensitivity
Low	>2.0	Low Sensitivity

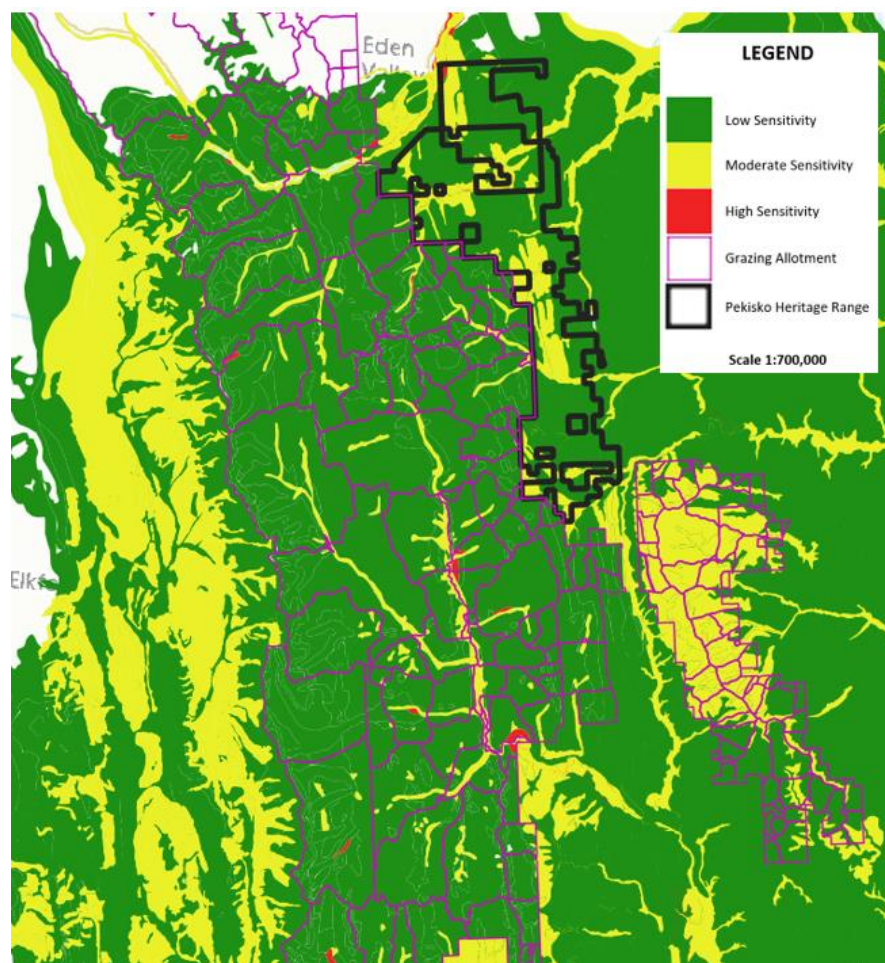


Figure 12. Sensitivity to Acidification after correlation of Relative Risk Rating to Grid Cell Sensitivity Ratings per GoA 2014.

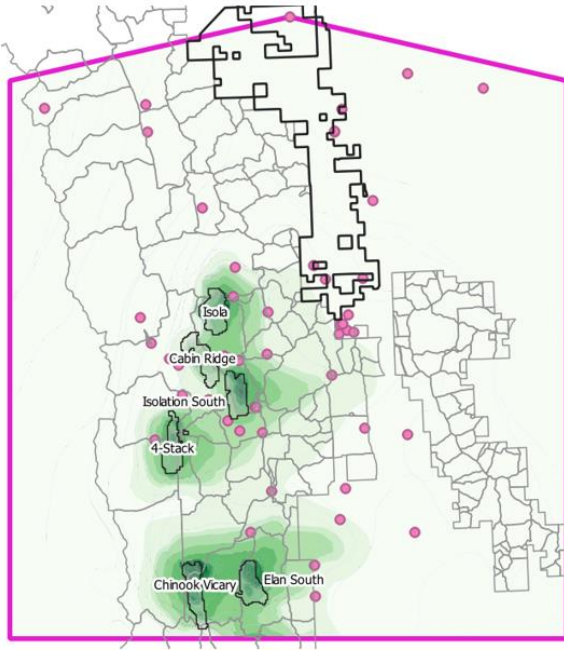


Figure 11a PAI_{dry}

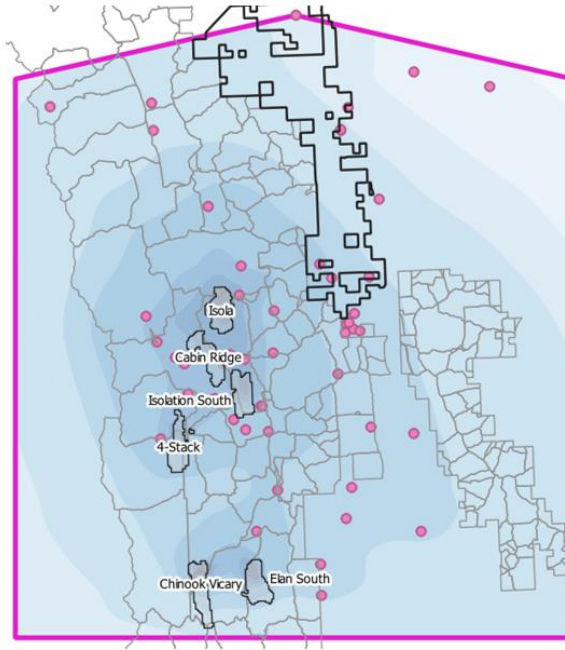


Figure 11b PAI_{wet}

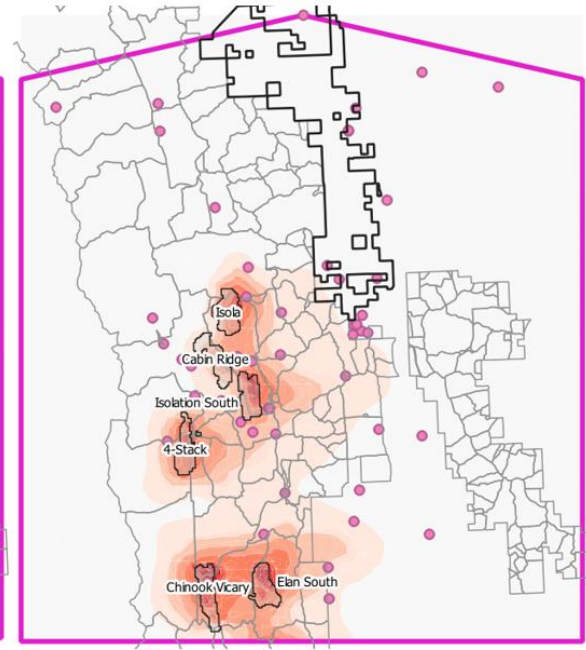


Figure 11c PAI_{total}

Figure 13a to c shows the computed outputs of the PAI_{dry} , PAI_{wet} and PAI_{total} , respectively. In the PAI_{total} , the resultant isopleths of the PAI_{dry} and the PAI_{wet} were combined with the subtractive effect of base cation deposition on PAI. The deposition modelling predicted detectable PAI at low levels throughout the modelling domain (purple boundary). The PAI_{total} scenario was then interpolated to determine the isopleths representing the critical, target, and monitoring loads.

Vegetation Effects Due to Nitrogen and Sulphur Deposition

Acidic input effects on vegetation were typically indirect effects. Accumulation of metals (mainly aluminum) in leaves, decreased vigour and reproduction, and increased incidence of disease were examples of vegetation effects which may follow changes in soil and/or water chemistry. Vegetation effects were not considered in the derivation of critical loads because soil and water effects occur earlier, were more readily measured, and were more definitive (AENV 1999). In order to evaluate the potential effects of acidifying emissions on vegetation, individual receptor locations for nitrogen and sulphur wet and dry deposition rates were reviewed. The values, which were presented in units of $\text{ug m}^{-2} \text{s}^{-1}$, were compared to literature values completed around the world for various grassland and boreal ecological communities that have studied the effects of N and S deposition on plant community composition (e.g. changing competition dynamics), biodiversity indices, resilience to ecological stressors (e.g. drought) (Verma and Sagar 2020; APIS 2016; Wen-Juan et al. 2019; Bobbink et al 2013; Lovett 2013; Reinds et al 2008). For the purposes of this study, a critical load of $6 \text{ kg ha}^{-1} \text{yr}^{-1}$ ($0.02 \text{ ug m}^{-2} \text{s}^{-1}$) (MacKenzie and Dietrich 2020). In the case of S, direct toxicity and nutrient deficiencies resulting from deposited S uptake by vegetation was considered and a critical level for protecting natural environments was selected as 20 ug m^{-3} (annual mean) (WHO 2000).

Figure 14 shows the pathways of direct and indirect effects of dry and wet N deposition on flora and fauna. Of principal concern to this study is the potential for N deposition to affect the quality of rangeland that is used for cattle ranching in terms of forage quality and quantity, and the resilience of the forage to ecological stressors that this region is exposed to, namely drought. A comprehensive inventory of the grazing species and capability that occur in the region was completed by Sue Michalsky of Paskwa Consultants Ltd. (Paskwa 2011) for the Rocky Mountain Forest Range Association. The scope of this study does not include an evaluation of the predicted impacts to the ecological communities described in this, or similar, inventories; rather it provides part of the understanding of baseline conditions in the region which might be compared to in the future.

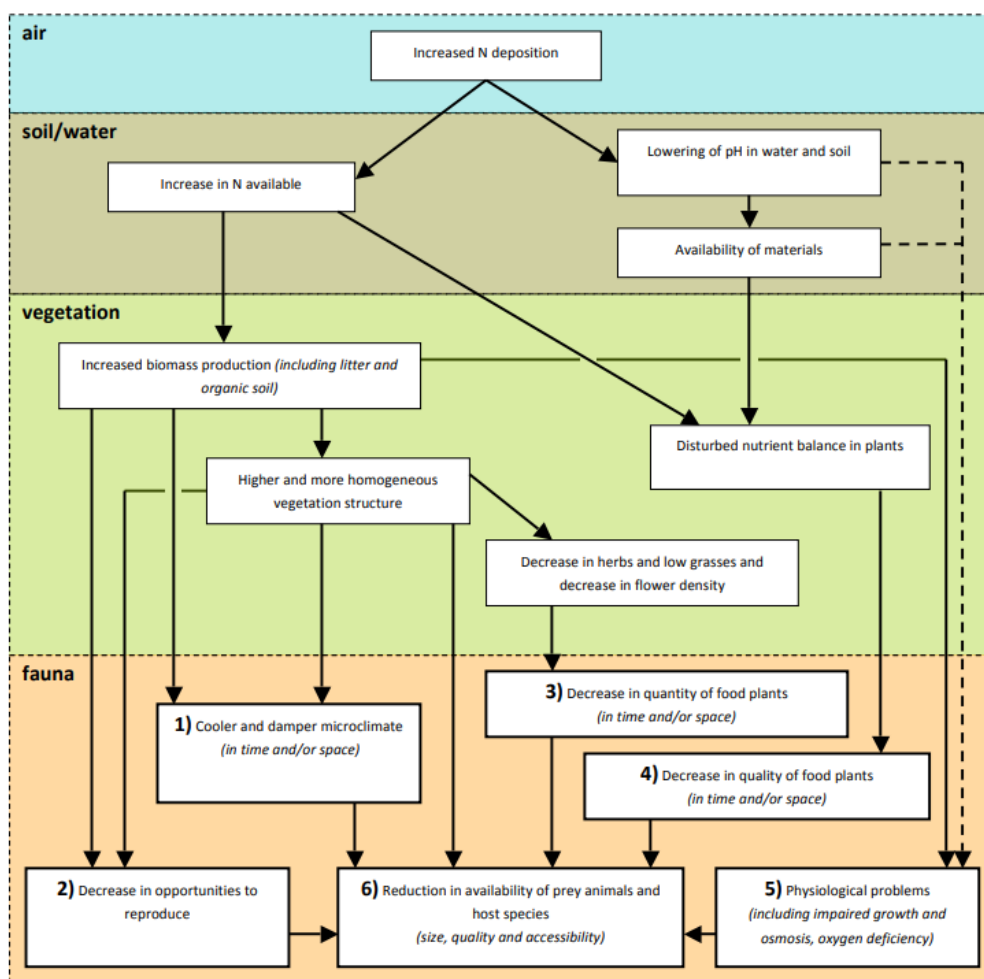


Figure 14. Direct and Indirect effect pathways of N deposition on the structure and functioning of ecosystems (from Bobbink et al 2013).

Health Risk Assessment

The methods described below were adapted from federal (Health Canada, 2019) and international guidance (US EPA, 2005) for assessing risks to human and livestock health from exposure to contaminants through agricultural land uses, the primary land use in the Livingstone and Pekisko areas (Figure 2).

Risks to ranchers and livestock were assessed through direct exposure to contaminants in air and ingestion of local foods.

The methods described below present a likely underestimation of potential health risks to ranchers and livestock as ingestion of potentially contaminated drinking water sources (surface water and shallow groundwater springs) was not undertaken in this study.

Water quality modelling for all potential sources of contaminants from coal mining was not available and estimates of surface deposition to water would not provide an accurate representation of the potential for contamination of surface water from the planned development case. Predicted concentrations of selenium were available but not included in the risk assessment as selenium is one chemical in the complex mixture of potential contaminants released from coal mines (Stelfox, B. and Donahue, B. 2021; Chernos, M. et. al., 2021).

Problem Formulation

The conceptual site model presented in Table 4 was used to identify potential sources of contaminants from coal mines identified in previous coal mine risk assessments (Millenium EMS, 2016), including the following trace elements and metals and PAHs. PAHs were assessed by group based on carcinogenicity and molecular weight as prescribed by the federal government (CCME, 2010).

Trace elements and heavy metals

- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Cobalt
- Copper
- Lead
- Manganese
- Mercury
- Molybdenum
- Nickel
- Selenium
- Thallium
- Uranium
- Vanadium
- Zinc

Polycyclic Aromatic Hydrocarbons

- High Molecular Weight (Carcinogens)
 - Benz(a)anthracene
 - Benzo(a)pyrene
 - Benzo(b)fluoranthene
 - Benzo(g,h,i)perylene
 - Benzo(k)fluoranthene
 - Chrysene
 - Dibenzo(a,h)anthracene
- Low Molecular Weight (Non-carcinogens)
 - Acenaphthene
 - Acenaphthylene
 - Anthracene
 - Fluoranthene
 - Fluorene
 - Naphthalene
 - Phenanthrene
 - Pyrene

The CSM identifies exposure pathways and receptors linked to agricultural land uses, summarized below, and was designed to assess potential risks to livestock and ranching families in the Livingstone and Pekisko areas (Figure 3).

Exposure pathways

- Inhalation of ambient air
- Ingestion of forage
- Ingestion of locally raised beef

Receptors

- Plants
 - Forage crops
- Livestock
 - Cow
 - Calf
- Ranchers
 - Adult
 - Child

Discrete receptor locations were identified by local ranchers and represent residences, livestock operations, recreational areas, and livestock grazing and water areas (Figure 7; Appendix A Table A.2).

Potential risks to livestock and ranchers were assessed at three key areas and results were presented below:

- MPOI: the Maximum Point of Impingement which represents the highest predicted Ground Level Concentration (GLC) from the air dispersion modelling described above,
- BLADE_C: a residential cabin at the base of Cabin Mountain
- PLT_SW: grazing allotment with the highest predicted GLC (southwest corner of the Plateau grazing lease)

Exposure pathways for air emissions to ecological receptors were also likely to occur and future studies should assess potential risks to the environment through an ecological risk assessment of the planned development case.

Exposure Assessment

In the exposure assessment the predicted concentrations of air contaminants were used to estimate soil concentrations and the uptake and transfer from soil and air to plants, cattle and ranchers as discussed below.

Concentrations and deposition of air contaminants to surface soils was estimated for two scenarios accounting for various dust control efficacies, 50% (S50) and 0% (S0) dust suppression.

While unlikely, the 0% dust suppression scenario was used as a worst-case scenario which may occur if water availability is limited and inadequate to support dust management plans, as suggested by the results presented in (Stelfox, B. and Donahue, B. 2021; Chernos, M. et. al., 2021) and as an indication of the magnitude to which health risks were dependent on fugitive dust mitigation techniques and risk management plans.

As described previously, predicted concentrations were modeled using emission rates which accounted for 50% (PM_{2.5}) or 80% (TSP) suppression (Millennium EMS (2016). Depending on the suppression considered in the air dispersion model exercise the appropriate scaling factor was applied. For PM_{2.5} a factor of 1/0.5 (2) was applied and for TSP a factor of 1/0.2 (5) was applied.

Estimated air concentrations of trace elements, heavy metals, and PAHs

Trace element and heavy metal air concentrations ($\mu\text{g}/\text{m}^3$) were estimated from Total Suspended Particulates (TSP) associated with fugitive dust and diesel exhaust sources by applying Emission Multipliers (EMs) to predicted concentrations ($\mu\text{g}/\text{m}^3$). Air concentrations of PAHs ($\mu\text{g}/\text{m}^3$) associated with diesel exhaust released to air were estimated from the predicted concentration of PM_{2.5} ($\mu\text{g}/\text{m}^3$). EMs (g/g) were calculated from overburden soil sampling reported in Millennium EMS (2016b, Table 5.5-1).

Provincial monitoring data is not available for soils in the Livingstone or Pekisko area and data describing aluminum, or manganese concentrations in overburden were not provided, therefore these contaminants could not be assessed.

Emission multipliers were presented in Table 10 and estimated air concentrations of trace elements, heavy metals, and PAHs were provided in Appendix F.

As previously discussed, emission estimations reflecting 80% dust reduction efficiency are unrealistic and would result in an underestimate of dust emissions. Since metals emissions (and therefore effect on ambient concentrations) from overburden, rock, and coal were based on TSP emissions, the predictions may be underestimated. To address the potential underestimation model results for 80% reduction scenarios were scaled to 50% reduction.

Table 10. Summary of Metal Emission Multipliers (g/g) for Diesel Combustion (PM_{2.5}) and TSP Emissions

Multiplier for Soil Emissions (g/g of TSP)		Multiplier for Diesel Combustion (g/g of PM _{2.5})	
COPC		COPC	
Aluminum	n/a	Acenaphthene	9.80E-05
Antimony	1.28E-06	Acenaphthylene	1.93E-04
Arsenic	3.15E-06	Anthracene	2.60E-05
Barium	1.85E-04	Benz(a)anthracene	1.30E-05
Beryllium	1.00E-06	Benzo(a)pyrene	5.00E-06
Cadmium	1.34E-06	Benzo(b)fluoranthene	2.30E-05
Chromium	1.10E-05	Benzo(g,h,i)perylene	1.20E-05
Cobalt	9.20E-06	Benzo(k)fluoranthene	5.00E-06
Copper	2.90E-05	Chrysene	3.20E-05
Lead	1.37E-05	Dibenzo(a,h)anthracene	7.00E-06
Manganese	n/a	Fluoranthene	8.40E-05
Mercury	1.14E-07	Fluorene	2.67E-04
Molybdenum	2.10E-06	Indo(1,2,3-cd)pyrene	9.00E-06
Nickel	3.05E-05	Naphthalene	2.71E-03
Selenium	1.22E-06	Phenanthrene	8.52E-04
Thallium	5.00E-07	Pyrene	7.70E-05
Uranium	2.00E-06		
Vanadium	4.00E-05		
Zinc	1.61E-04		

Estimating air deposition and soil concentrations

Total deposition of base cations, trace elements, metals, and PAHs to soils from wet and dry processes was estimated as follows and unitized annually.

The wet deposition velocity (0.000008 g/s) was estimated from the annual average precipitation reported at the Environment Canada Climate Station Pekisko from 1998-2007⁵ and provided in Appendix G. The dry deposition velocity of 0.01 (m/s) was adopted from Eder and Dennis (1990). D deposition flux was estimated as described in (US EPA) 2012.

$$\text{Deposition} \left(\frac{\text{mg}}{\text{m}^2} / \text{year} \right) = \text{Annual average air concentration} \left(\frac{\text{mg}}{\text{m}^3} \right) \times \text{deposition velocity} \left(\frac{\text{m}}{\text{s}} \right)$$

$$\text{Total deposition} \left(\frac{\text{mg}}{\text{m}^2} / \text{year} \right) = \text{Wet deposition} + \text{Dry deposition}$$

⁵ https://climate.weather.gc.ca/climate_data/monthly_data_e.html?hlyRange=2005-05-10%7C2021-09-02&dlyRange=1998-02-01%7C2021-09-02&mlyRange=1998-05-01%7C2007-11-01&StationID=10665&Prov=AB&urlExtension=_e.html&searchType=stnProv&optLimit=yearRange&StartYear=2016&EndYear=2021&selRowPerPage=25&Line=205&Month=9&Day=2&lstProvince=AB&timeframe=3&Year=2007

Soil concentrations of trace elements, metals, and PAHs (mg/kg) were estimated from total deposition of as follows (US EPA, 2005; Millennium EMS, 2016c).

$$Ds \left(\frac{mg}{kg} / year \right) = Zs(m) \times \rho B \left(\frac{kg}{m^3} \right)$$

Ds = Deposition to soil (mg/kg/yr)

Zs = Soil mixing depth (m)

ρB = Soil bulk density (kg/m³)

$$Cs \left(\frac{mg}{kg} \right) = Ds \left(\frac{mg}{kg} / year \right) \frac{1 - e(kt \text{ (years)} \times tD \text{ (years)})}{kt \text{ (years)}}$$

Cs = Concentration in soil (mg/kg)

Ds = Deposition to soil (mg/kg/yr)

kt = soil loss constant for biotic and abiotic degradation (-5.16×10^{-7} (yrs⁻¹))

tD = time period over which deposition occurs (50 years)

Predicted soil concentrations for trace elements, heavy metals, and PAHs for 50% and 0% dust reduction scenarios were provided in Appendix H.

Baseline soil quality data was available within the study area but limited to a single sample in the vicinity of the proposed Grassy Mountain mine in overburden (Millennium EMS, 2016b). The available soil data is limited and does not provide adequate characterization of baseline soil quality in the study area but was included as an indication of how risk levels may change when naturally occurring concentrations of trace elements and heavy metals present in soils were considered in addition to coal mine development under the PDC. Baseline concentrations were presented in exposure assessment Results and associated appendices.

Estimating plant and beef tissue and milk residues

The following multi-media fate and transport calculations (US EPA, 2005) were used to predict the uptake and sequestration of COPCs into plant and beef tissue and milk (for nursing calves) and the daily exposure dose from ingestion of the identified food items. Estimates of milk residues were required to assess potential risks in nursing calves.

Estimated residues were presented in the Results section and associated appendices.

Exposure factors reflect the physical characteristics and behaviour of receptors by age and were required to estimate uptake and exposure and provided in Appendix I. Human exposure factors were adopted from Health Canada (2019) and cattle exposure factors were provided by local ranchers in the Pekisko Heritage Range and beef ingestion rates were adopted from US EPA (2005).

Bioconcentrations factors were adopted from the US EPA (2005) companion database and Balanov, M. et., al. (2010).

Forage concentrations due to root uptake from soil

$$P_i = C_s \times B_{r\text{forage}}$$

P_i = Concentration of COPC in forage/silage/grain due to root uptake mgCOPC/kg plant tissue)

C_s = Average soil concentration over exposure duration (mg/kg)

$B_{r\text{forage}}$ = Plant-soil bioconcentration factor for forage/silage, or grain ((mg COPC/kg plant)/(mg COPC/kg soil))

Beef concentrations due to plant and soil ingestion

$$C_{\text{beef}} = \left(\sum (F_i \times Q_{pi} \times P_i) = Q_s \times C_s \times B_s \right) \times B_{\text{abeef}} \times MF$$

C_{beef} = Concentration of COPC in beef (mg COPC/kg tissue)

F_i = Fraction of plant type (i) grown on contaminated soil and ingested by the animal (0.5; unitless)

Q_{pi} = Quantity of plant type (i) ingested by the animal per day (kg forage/day)

P_i = Concentration of COPC in forage/silage/grain due to root uptake mgCOPC/kg plant tissue)

Q_s = Soil ingestion rate (kg/day)

C_s = Average soil concentration over exposure duration (mg/kg)

B_s = Soil Bioavailability factor (unitless)

B_{abeef} = Biotransfer factor for beef (day/kg tissue)

MF = Metabolism Factor (unitless)

Cattle milk concentrations due to plant and soil ingestion

$$C_{\text{milk}} = \left(\sum (F_i \times Q_{pi} \times P_i) = Q_s \times C_s \times B_s \right) \times B_{\text{amilk}} \times MF$$

C_{milk} = Concentration of COPC in beef (mg COPC/kg tissue)

F_i = Fraction of plant type (i) grown on contaminated soil and ingested by the animal (0.5; unitless)

Q_{pi} = Quantity of plant type (i) ingested by the animal per day (kg forage/day)

P_i = Concentration of COPC in forage/silage/grain due to root uptake mgCOPC/kg plant tissue)

Q_s = Soil ingestion rate (kg/day)

C_s = Average soil concentration over exposure duration (mg/kg)

B_s = Soil Bioavailability factor (unitless)

B_{amilk} = Biotransfer factor for milk (day/kg tissue)

MF = Metabolism Factor (unitless)

Estimating daily exposure in cattle and ranchers

Estimated Daily Intake (EDI) of contaminants by cattle (cows and calves) and ranchers (adult and children) were calculated using Health Canada (2019) guidance, which is similar to US EPA (2005). A modified calculation was generated to assess exposure and uptake of contaminants in nursing calves.

Estimated daily COPC intake by cows

$$EDI_{cow} = \frac{(P_i \times PIR \times F_i) + (C_s \times SIR) + (C_{air} \times IR)}{bw}$$

EDI_{cow} = Estimated daily intake for cows (mg/kg bw/day)

P_i = Concentration of COPC in forage/silage/grain due to root uptake mgCOPC/kg plant tissue)

PIR = Plant (forage) Ingestion Rate (kg/day)

F_i = Fraction of forage consumed from study area

C_s = Average soil concentration over exposure duration (mg/kg)

SIR = Soil Ingestion Rate (kg/d)

C_{air} = Concentration in air (mg/m³)

IR = inhalation Rate (m³/day)

BW = Body weight (kg)

Estimated daily COPC intake by calves

$$EDI_{calf} = \frac{(C_{milk} \times MIR) + (P_i \times PIR \times F_i) + (C_s \times SIR) + (C_{air} \times IR)}{bw}$$

EDI_{calf} = Estimated daily intake for cows (mg/kg bw/day)

C_{milk} = Concentration of COPC in cow milk (mgCOPC/L)

MIR = Milk ingestion rate (L/day)

P_i = Concentration of COPC in forage/silage/grain due to root uptake mgCOPC/kg plant tissue)

PIR = Plant (forage) Ingestion Rate (kg/day)

F_i = Fraction of forage consumed from study area

C_s = Average soil concentration over exposure duration (mg/kg)

SIR = Soil Ingestion Rate (kg/d)

C_{air} = Concentration in air (mg/m³)

IR = inhalation Rate (m³/day)

BW = Body weight (kg)

Estimated daily COPC intake by ranchers (adult and child; non-carcinogens)

$$EDI_{rancher} = \frac{(C_{beef} \times BIR)}{bw}$$

EDI_{calf} = Estimated daily intake for cows (mg/kg bw/day)

C_{beef} = Concentration of COPC in beef (mgCOPC/L)

BIR = Beef ingestion rate (L/day)

BW = Body weight (kg)

Estimated daily COPC intake by adult ranchers (carcinogens)

$$EDIrancher = \frac{((C_{beef} \times BIR) + (C_{air} \times IR)) \times D_1 \times D_2 \times D_3 \times D_4}{bw \times LE}$$

EDI_{calf} = Estimated daily intake for cows (mg/kg bw/day)

C_{beef} = Concentration of COPC in beef (mgCOPC/L)

BIR = Beef ingestion rate (L/day)

C_{air} = Concentration in air (mg/m³)

IR = inhalation Rate (m³/day)

D₁ = hours per day exposed/24 hours

D₂ = days per week exposed/7 days

D₃ = weeks per year exposed/52 weeks

D₄ = total years exposed to site

BW = Body weight (kg)

Lf = Life expectancy (years)

Toxicity Assessment

To assess potential adverse effects to a receptor following an exposure, a “safe level” of exposure must be known. The toxicity assessment step characterizes the toxicological properties and effects of a substance, specifically, the dose-response relationship associated with a route of exposure and identifies an acceptable threshold of exposure on a short or long-term basis to protect from adverse effects.

Toxicity assessment in this risk assessment includes identifying:

- Toxicity Reference Values (TRVs) (non-carcinogens): published, scientifically-reviewed thresholds against which class or species type receptors can be compared by COPC
- Slope Factors (SFs) carcinogens: The slope of the dose-response relationship relating to exposure dose or unit risk and, when multiplied by the exposure level (dose or concentration as appropriate), it provides an upper bound estimate of the probability of occurrence of cancer or germ cell mutation in a chronically exposed population.
- Media specific Guidelines: thresholds that offer protection to several classes of receptors and population/ community level effects against which concentrations of COPCs in air or soil can be screened to identify potential risks.

Typically, exposures below TRVs indicate negligible risks of exposure and adverse human health or environmental effects would not be a concern.

Toxicity thresholds were receptor specific and differ between animal classes based on physiological, cellular and molecular variability between species and classes of animals. Therefore, plant, human (rancher) and cattle specific TRVs were discussed and presented for each COPC.

Individual COPCs may not have defined TRVs or guidelines for a number of reasons including; emerging contaminant lacking toxicity information, exposure route not applicable, no known toxicity. In all but the latter the lack of a TRV or guideline does not exclude the potential for risk and future work will be required to understand the true potential risks from exposure.

Toxicity Reference Values were adopted from the US EPA (Ecological soil-screening levels (Eco-SSLs); Provisional Peer-Reviewed Toxicity Values (PPRTVs)) for cattle and Health Canada (2010) and US EPA (Integrated Risk Information System (IRIS)) for ranchers.

Potential impacts to soil quality and associated biota (plants, cattle) were assessed by comparing estimated soil concentrations for each COPC to Alberta Tier 1 soil quality guidelines for agricultural land uses and (AEP, 2019b) and Eco-SSL guidelines except for PAHs which were assessed by molecular weight and carcinogenic potential groupings (CCME, 2010). Predicted concentrations of air quality were compared to previously described guidelines published by Alberta (2019), Canada (undated) and the WHO (2018).

The TRVs and guidelines identified in Table 11 were selected to assess potential risks to plants, cattle and humans from exposure to COCPs related to metallurgical coal mining air emissions. Detailed of TRV and guideline selection were provided in Appendix J.

Table 11. TRVs and guidelines to assess potential risks to plants, cattle, and humans from exposure to COCPs related to metallurgical coal mining air emissions.

	Toxicity Reference Value					Guideline		
	Oral			Air		Soil		
	Cattle	Ranchers		Ranchers		Cattle	Plant	Agriculture
		Adult	Child	Adult	Child			
		mg/kg bw day		mg/m3			mg/kg	
Aluminum	1.930	1					Not required	
Antimony	0.059	0.0004				0.270	---	20
Barium	51.800	0.2				2000	---	750
Beryllium	0.532	0.002				21	---	5
Cadmium	0.770	0.001				0.36	32	4
Chromium	2.400	0.001				34 (CrIII)	---	64 (Total)
Cobalt	7.330	0.010	0.0003			230	13	20
Copper	5.600	0.141	0.11			49	70	63
Lead	4.700	0.001				5	12	70
Manganese	51.500	0.156	0.136			4000	220	---
Mercury	1.000	0.0003						12
Molybdenum		28.000	23.000					4
Nickel	1.700	0.011		0.000018		130	38	45
Selenium	0.143	5.700	6.200			0.630	0.52	1
Thallium	0.013	0.00001						1
Uranium		0.001						33
Vanadium	4.160	1.8				280		130
Zinc	75.400	0.570	0.490			79	160	250
Low MW PAHs (Sum non-carcinogenic PAHs)	65.500	0.02				100		0.017
	Non-threshold (carcinogens)							
	Slope Factor (mg/kg bw d)					mg/kg		
Arsenic	1.04	1.8		27		46	18	17
High MW PAHs (Sum BaP Equivalents)	0.615	2.3		0.13		1		0.6

Risk Analysis

Finally, risks were analyzed by comparing the results of exposure assessment to toxicity and risk-based thresholds to calculate the Hazard Quotient (HQ) for non-carcinogens by summing oral and inhalation exposure HQs calculated as follows. Incremental Lifetime Cancer Risks (ILCR) were calculated for carcinogenic substances by exposure route using slope factors as exposure rates were used to estimate daily exposure as body weight and not compared to predicted media concentration.

An HQ less than 1.0 indicates that predicted exposures were less than the health threshold and exposure is unlikely to result in adverse effects in exposed receptors. An HQ greater than 1 indicates a potential risk from exposure under the scenario assessed and further investigation or management is required.

For carcinogenic compounds, the potential risk of adverse health effects is assessed as the likelihood of cancer outcomes in a population of 100,000 and deemed essentially negligible when the ILCR is less than 1 in 100,000 as per Alberta Health (2019) guidance. Estimated ILCRs over this target should be investigated further to better understand the potential risks and identify risk management or mitigation which may be required.

Hazard Quotient Calculation (oral exposure)

$$HQ = \frac{EDI \left(\frac{mg}{kg} bw \text{ day} \right)}{TRV \left(\frac{mg}{kg} bw \text{ day} \right)}$$

HQ = Hazard Quotient (unitless)

EDI = Estimated daily intake for each COPC and receptor (mg/kg bw/day)

TRV = Toxicity reference value for each COPC and receptor or class (mg/kg bw/day)

Hazard Quotient Calculation (inhalation exposure)

$$HQ = \frac{C_{air} \text{ concentration } \left(\frac{ug}{m^3} \right) \times \text{Inhalation Rate } \left(\frac{m^3}{d} \right)}{TRV \left(\frac{ug}{m^3} d \right)}$$

HQ = Hazard Quotient (unitless)

C_{air} = Concentration in air (mg/m³)

IR = inhalation Rate (m³/day)

Incremental Lifetime Cancer Risk Calculation (oral exposure)

$$ILCR = EDI_{oral} \left(\frac{mg}{kg} bw \text{ day} \right) \times SF_{oral} \left(\frac{mg}{kg} bw \text{ day}^{-1} \right) + EDI_{inh} \left(\frac{mg}{kg} bw \text{ day} \right) \times SF_{inh} \left(\frac{mg}{kg} bw \text{ day}^{-1} \right)$$

ILCR = Incremental Lifetime Cancer Risk (unitless)

EDI_{oral} = Estimated daily intake for each COPC and receptor (mg/kg bw/day)

EDI_{inh} = Estimated daily intake for each COPC and receptor (ug/m³ bw d)

SF = Slope Factor (mg/kg bw/day⁻¹)

Results

Results from air dispersion modeling and air and health risk assessments were provided below.

Air Quality Predictions and Assessment

The following sections present predicted air concentrations and deposition for air contaminants emitting from eight mines operating simultaneously during the PDC. Predicted GLCs from CALPUFF modelling are provided in Appendix K.

Isopleths providing a geospatial representation of the predicted air concentrations as contours over study area and interception with discrete receptor locations and grazing allotments are provided in Appendix L.

The isopleth presents concentration-based contours for each parameter by statistical measure and averaging period as an indication of the geographic extent of predicted air quality within the study area. Available air quality thresholds have also been identified on each isopleth to provide an indication of areas which are predicted to exceed health-based levels and could result in potential health risks to receptors within these areas.

In the example provided below for the annual daily TSP predictions, the areas inside the red contour are predicted to exceed the annual AAAQO identified for the protection of adverse effects on the pulmonary system (i.e. lung effects) by AEP (2019). Therefore, any human receptors present within these areas could be at risk of pulmonary effects.

It is important to also interpret the isopleths and predicted concentrations in proximity to the 8 prospective coal mines under the PDC. As shown in Figure 15, exceedances of the daily TSP AAAQO are predicted closer to the mine sites, however, these mine sites intersect grazing allotments leased to ranches (Rocking P Ranch, Plateau Cattle Co., Waldron and Spruce Community Association) and the assumption that cattle and humans will not be within the areas overlaying or close to mines cannot be made, as is generally practice in project applications (Millenium EMS, 2016a,b,c).

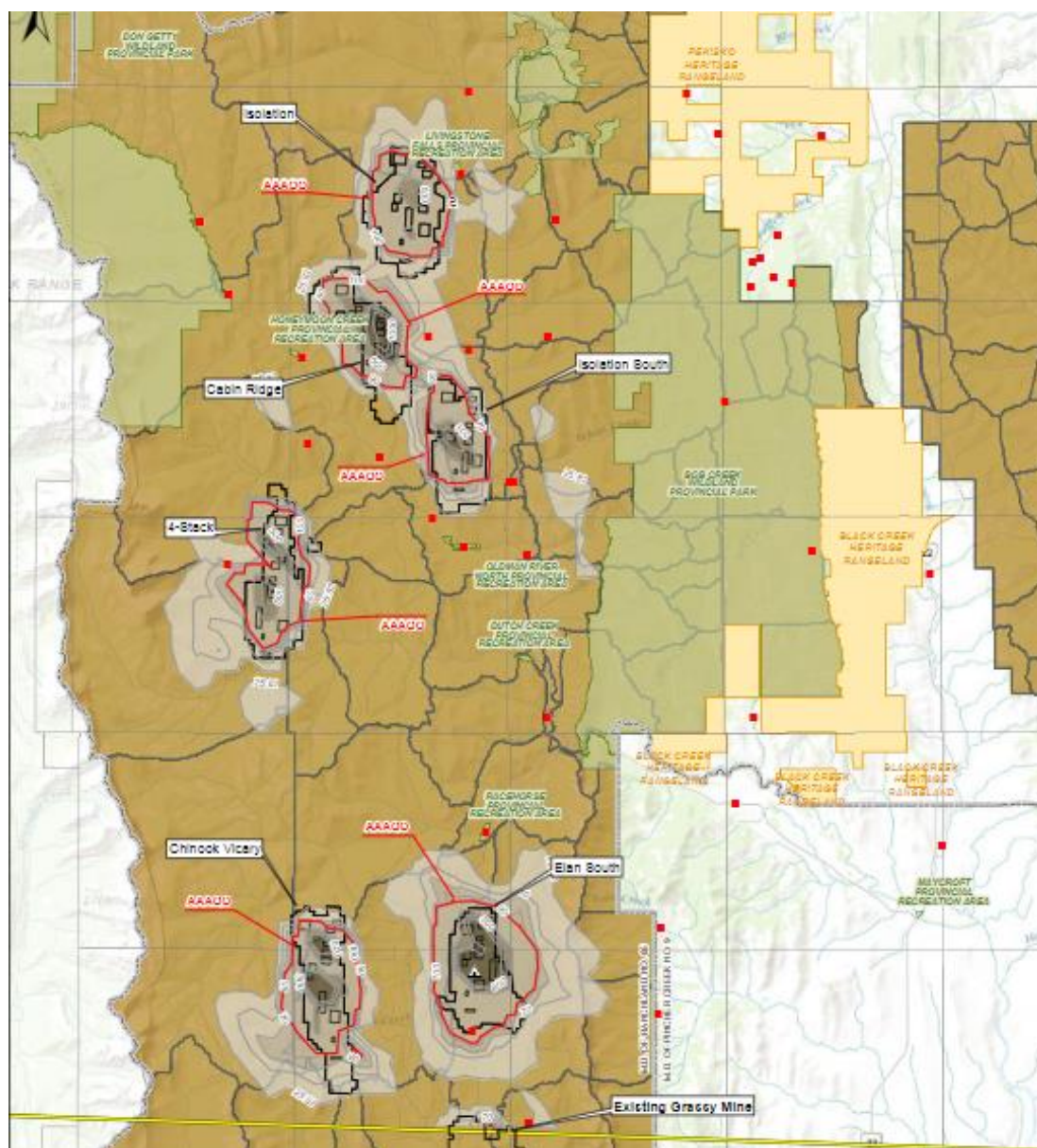


Figure 15. Example of an air quality isopleth showing potential mine locations, discrete receptor locations, predicted air concentration contours and locations exceeding available health-based thresholds (Alberta Ambient Air Quality Objectives AEP 2019) over the study area.

Sulphur dioxide

Predictions at the maximum point of impingement (MPOI) represent the location with the highest predicted concentration of SO₂ within the study area as shown in Appendix L. Comparison of MPOIs to the lowest available guidelines are presented in Table 12 below. Concentrations of SO₂ predicted at discrete receptor locations for the PDC are provided in Appendix K.

Hourly, daily, and monthly predicted air concentrations of SO₂ did not exceed provincial, federal, or global air quality objectives. Predicted concentrations from a single year did not meet the requirements for comparison to annual CAAQS (requires average over 3 years) however the results from single year indicate that there could be potential exceedances of the CAAQS at the MPOI.

As shown in the grey shaded areas in Figure 16, SO₂ emissions are predicted to intercept grazing allotment and heritage rangelands in the study area warranting an assessment of potential acid input from formation and deposition of acid compounds (see Acid Deposition and Vegetation health assessment and Results).

Table 12. Predicted exceedances of SO₂ (ug/m³) at the MPOI from the planned development case coal mine air emissions.

Average Period	Predicted Concentration (ug/m ³)				Source	Predicted Exceedance
	Maximum	99 th percentile	99 th percentile of daily peak	Lowest Guideline		
Hourly	32.23	28.96	---	183	CAAQS	No
Daily	12.08	---	---	20	WHO	No
Monthly	2.69	---	---	30	AAAQO	No
Annual	1.93	---	---	20	AAAQO	No
		---	30.84	13.08	CAAQS	Potential

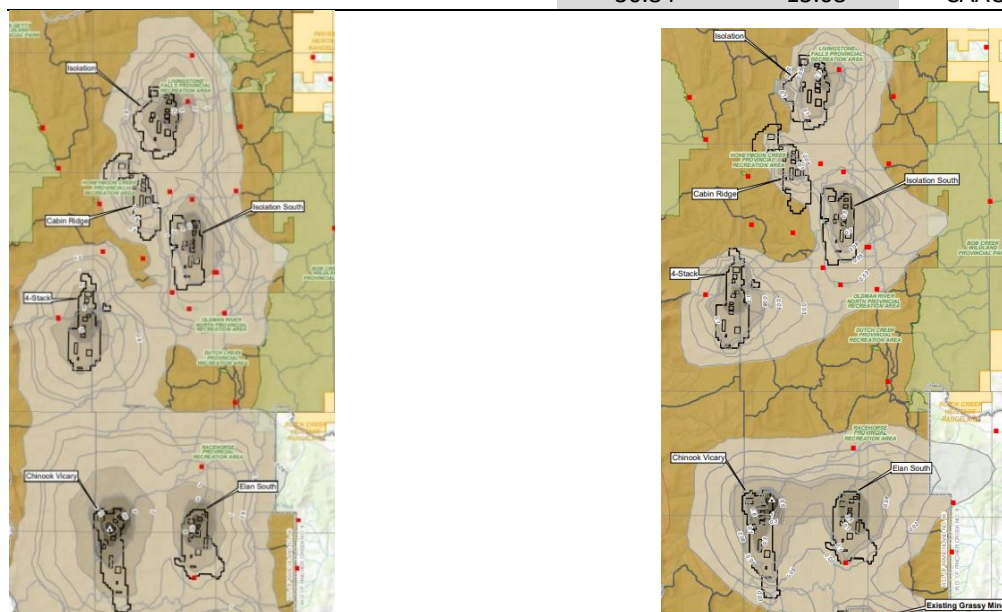


Figure 16. Hourly (left) and annual (right) predicted concentrations of sulphur dioxide (ug/m³) in the study areas from the planned development case (complete isopleth provided in Appendix L).

Nitrogen dioxide

Concentrations of NO₂ predicted at discrete receptor locations for the PDC are presented in Appendix K. Comparison of predicted concentrations at MPOIs and discrete receptor locations to available guidelines are presented in Table 13 below. Exceedances of various guidelines are indicated by the corresponding colour shaded cell.

Table 13. Predicted exceedances of NO₂ at the MPOI and discrete receptor locations from the planned development case coal mine air emissions.

Average Period	Predicted Concentration (ug/m³)				Receptor ID	Guideline (ug/m³)			Predicted Exceedance
	Max	99.9th Percentile	98th Percentile Daily Peak	Average					
	MPOI					AAAQO	CAAQS	WHO	
Hourly	1263.10	1055.40	1011.00	32.28	644	300	112.83	200	Y
Annual	6.02E+01	---	---	60.21	645	45	31.97	40	Y
Sensitive Receptor Locations									---
Hourly	147.33	115.79	114.86	0.13	RH_CRK				Y
Hourly	399.89	292.67	292.67	4.54	LVST_F				Y
Hourly	295.64	243.53	233.10	0.69	N_RCKP				Y
Hourly	164.54	125.61	128.69	0.88	OM_RVR				Y
Hourly	164.69	123.69	123.21	1.07	ATRM_EN				Y
Hourly	294.39	243.60	240.51	1.80	BLADE_C				Y
Hourly	282.73	234.43	221.74	1.75	MCLY_CRK				Y
Hourly	183.00	132.52	130.93	0.00	RCKP_SW				Y
Hourly	255.79	243.87	235.30	1.00	R2				Y
Hourly	408.25	321.70	331.47	1.05	R11				Y

Hourly concentrations are predicted to exceed the provincial and federal guidelines for the protection of respiratory health at the MPOI located on the Chinook Vicary mine site and in all areas surrounding the other 7 potential mine sites and at sensitive receptor location including a residential cabin, grazing allotments, Livingstone Falls, the Oldman River and two creeks (Racehorse and Maclay) as shown in Table 13 and Figure 17 (from Appendix L).

Annual concentrations of NO₂ are predicted to exceed available guidelines for the protection of environmental (from acid deposition and eutrophication) and human health at the MPOI and in the vicinity of the potential Chinook Vicary and Elan South mine sites but not at discrete receptor locations as shown in **Error! Reference source not found.** and Figure 17 (from Appendix L).

Monitoring data is required to assess ambient air quality under the SSRP however, model predictions can be used to identify potential future issues with air quality and support planning (Alberta Government, 2014). As shown in Appendix L (NO₂ Annual Prediction) there could be potential exceedances of various SSRP triggers associated with two mine sites and local monitoring is required to assess baseline conditions prior to mine application submissions and to monitor potential deterioration in air quality in mine

applications are approved. Refer to Figure 5 for the existing SSRP monitoring network which does not cover the study area.

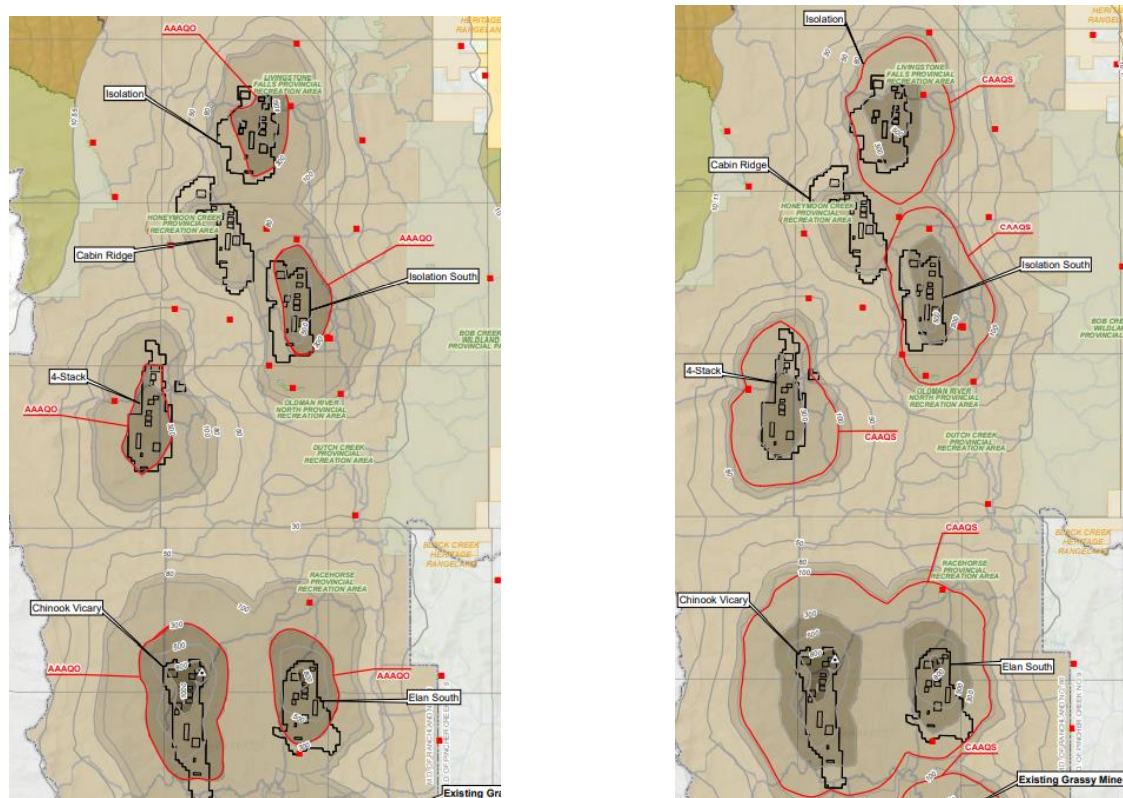


Figure 17. Hourly (left) and annual (right) predicted concentrations of nitrogen dioxide ($\mu\text{g}/\text{m}^3$) in the study areas from the planned development case (complete isopleth provided in Appendix L).

Particulate Matter

Total Suspended Particles

Predicted concentrations of TSP are presented in Appendix K. Comparison of the predicted concentrations at MPOIs and discrete receptor locations to available guidelines are presented in Table 16 below.

As shown in Figure 18 excerpts from Appendix L (TSP Daily and Annual Prediction), concentrations of TSP will exceed hourly and annual AAAQOs in areas close to mine sites which overlap with grazing allotments. The predicted exceedances also occur at or near recreational areas such as the Honeymoon Creek Provincial Recreational Area as shown in Figure 20 below for annual predictions (excerpt from Appendix L).

Potential risks to forage crops, livestock and ranch families from metal and PAH deposition are assessed and presented in the risk assessment Results section.

Table 14. Predicted exceedances of TSP at the MPOI from the planned development case coal mine air emissions.

Average Period	Predicted Concentration (ug/m3)				Guideline (ug/m3)			Predicted Exceedance
	Max	99.9th Percentile	98th Percentile	Average	AAAQO	CAAQS	WHO	
		MPOI						
Daily	-	-	-	2581.50	100	---	---	Y
Annual	-	-	-	719.01	60	---	---	Y

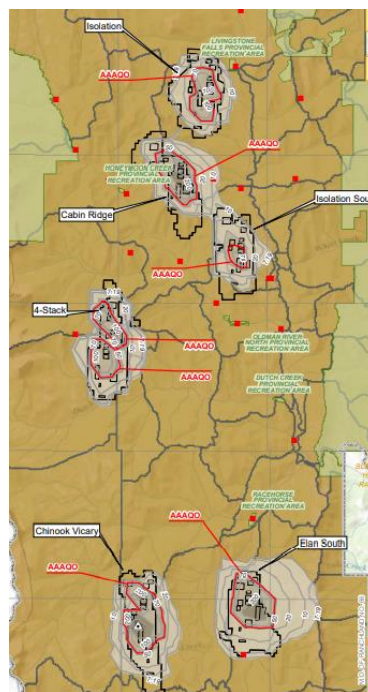
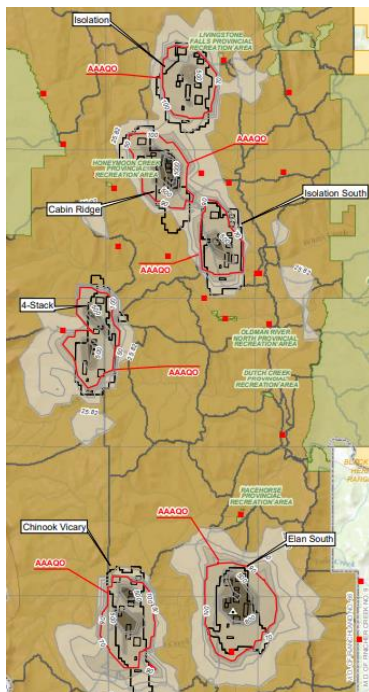


Figure 18. Daily (left) and annual (right) predicted concentrations of TSP ($\mu\text{g}/\text{m}^3$) in the study areas from the planned development case (complete isopleth provided in Appendix L).

PM₁₀

Predicted concentrations of PM₁₀ are presented in Appendix K. Comparison of the predicted concentrations at MPOIs and discrete receptor locations to available guidelines are presented in Table 15 below.

As shown in Appendix L (PM₁₀ Daily Prediction and Annual Prediction), concentrations of PM₁₀ will exceed hourly and annual WHO guidelines in areas close to mine sites which overlap with grazing allotments. The daily predictions indicate exceedances of the WHO guideline also occur at or near recreational areas such as the Livingstone Falls and Honeymoon Creek Provincial Recreational Area and more localized to mine sites for annual predictions as shown in Figure 19 below for annual predictions (excerpt from Appendix L).

Table 15. Predicted exceedances of PM₁₀ at the MPOI from the planned development case coal mine air emissions.

Average Period	Predicted Concentration ($\mu\text{g}/\text{m}^3$)				Guideline ($\mu\text{g}/\text{m}^3$)			Predicted Exceedance
	Max	99.9th Percentile	98th Percentile	Average	AAAQO	CAAQS	WHO	
	MPOI							
Daily	-	-	-	772.88	---	---	50	Y
Annual	-	-	-	185.92	---	---	20	Y

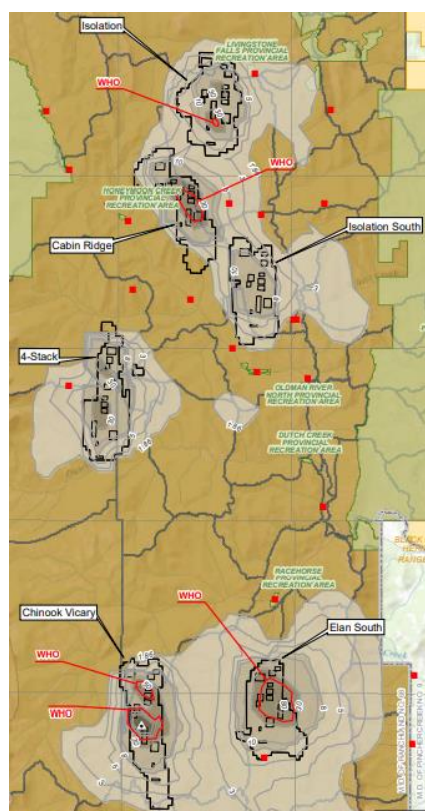
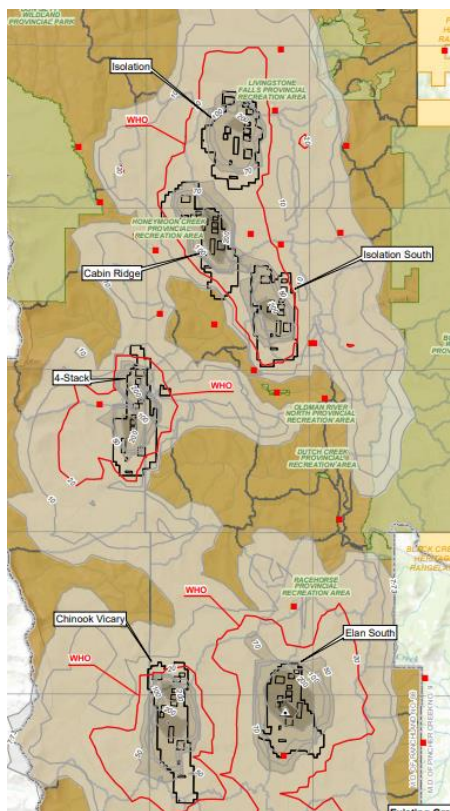


Figure 19. Daily (left) and annual (right) predicted concentrations of TSP ($\mu\text{g}/\text{m}^3$) in the study areas from the planned development case (complete isopleth provided in Appendix L).

PM_{2.5}

Comparison of the predicted concentrations (Appendix K) at MPOIs and discrete receptor locations to available guidelines are presented in Table 16 below. Exceedances of various guidelines are indicated by the corresponding colour shaded cell.

Hourly concentrations are predicted to exceed the provincial guideline at the MPOI located on the Chinook Vicary mine site and in all areas surrounding the other 7 potential mine sites as shown in Figure 20 (excerpt from Appendix L).

Annual concentrations of PM_{2.5} are predicted to exceed available guidelines for the protection of environmental (from acid deposition and eutrophication) and human health at the MPOI and in the vicinity of each of the mine sites but not at discrete receptor locations as shown in Table 16 and Figure 20 (from Appendix L).

Potential exceedances of SSRP triggers are also identified for predicted concentrations of PM_{2.5}, as shown for annual and daily time periods (Figure 20). As discussed previously, SSRP management triggers should be applied to monitoring data but can also support planning exercises (AEP, 2014).

Figure 20 also indicates that PM_{2.5} will be widely distributed within the study area and deposition could occur across grazing allotments, therefore risks to cattle and ranchers are assessed using the multimedia risk model (presented in the risk assessment results section).

Table 16. Predicted exceedances of PM_{2.5} at the MPOI from the planned development case coal mine air emissions.

Average Period	Predicted Concentration (ug/m3)				Guideline (ug/m3)			Predicted Exceedance
	Max	99.9th Percentile	98th Percentile	Average				
	MPOI				AAAQO	CAAQS	WHO	
Hourly	664.39	567.56	-	-	80	---	---	Y
Daily	205.90	-	114.82	24.82	29	27	25	Y
Annual	47.44	-	-	-	---	8.8	10	Y

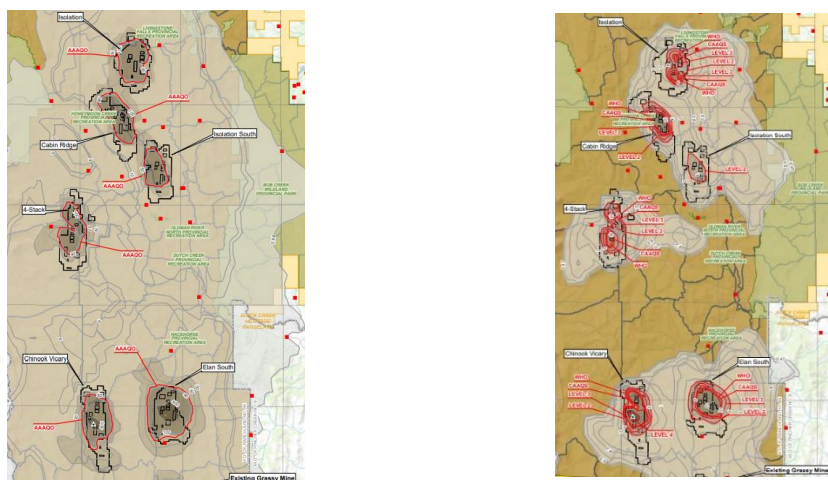


Figure 20. Hourly (left) and annual (right) predicted concentrations of $PM_{2.5}$ (ug/m^3) in the study areas from the planned development case (complete isopleth provided in Appendix L).

Trace Elements, heavy metals and PAHS

Several air concentrations of heavy metals and PAHs under the 50% dust reduction scenario are predicted to exceed provincial health-based thresholds on an hourly and annual basis under the Coal mine PDC, as shown Table 17. Detailed results of emission multiplier calculations to predict air concentrations of metals and PAHs are provided in Appendix F.

Table 17. Comparison of predicted air concentrations (ug/m^3) for heavy metals and PAHs with available Alberta Ambient Air Quality Objectives (AAAQOs, AEP 2019)

Parameter	Unit	Averaging period	Guideline	Predicted Air Concentration		
			AAAQO	MPOI	Cabin	Plateau
Arsenic	ug/m3	hourly	0.00001	0.074	0.00162	0.00074
		annual	10	0.006	0.00002	0.00007
Chromium		hourly	1	0.260	0.00564	0.00259
Lead		hourly	1.5	0.323	0.00703	0.00323
		annual	0.0002	0.025	0.00008	0.00031
Nickel	ug/m3	hourly	6	0.720	0.01564	0.00719
		annual	0.05	0.055	0.00018	0.00069
Benzo(a)pyrene		annual	0.0003	0.0002	2.67E-06	7.84E-06
Naphthalene		annual	3	0.1286	0.001447	7.84E-06

Shaded cells indicate exceedances of Alberta Ambient Air Quality Objectives (AEP, 2019)

Soil Quality Assessment

Estimated soil concentrations of heavy metals and PAHs from air deposition of under the 50% dust as compared to Alberta Tier 1 Soil Remediation Guidelines for Agricultural land Uses (AEP, 2019b), CCME Soil Quality Guidelines (CCME, 2010) and US EPA Eco SSLs (US EPA, various dates), as described in Appendix J, are provided in Table 18.

The analysis indicates that several heavy metals and the high MW weight PAH class (carcinogens) could exceed provincial remediation guidelines during the PDC. Detailed results of calculations to predict soil concentrations from air deposition are provided in Appendix H.

Table 18. Comparison of predicted soil concentrations (ug/mg) for heavy metals and PAHs to Alberta Tier 1 Agriculture Land Use Soil Quality Guidelines (AEP 2019b), CCME Soil Quality Guidelines (2010) and US EPA EcoSSL Guidelines for protection of plants and mammals (US EPA various dates).

Parameter	Unit	Predicted Soil Concentration					
		CCME	Guideline Alberta	US EPA	MPOI	Cabin	Plateau
PAHs							
Acenaphthene	mg/kg	---	0.33	---	5.90E-04	6.64E-06	1.95E-05
Acenaphthylene		---	---	1.16E-03	1.31E-05	3.84E-05	
Anthracene		2.5	1.3	---	1.57E-04	1.76E-06	5.17E-06
Benz(a)anthracene*		0.1	---	---	7.83E-05	8.81E-07	2.59E-06
Benzo(a)pyrene*		20	---	---	3.01E-05	3.39E-07	9.95E-07
Benzo(b)fluoranthene*		0.1	---	---	1.39E-04	1.56E-06	4.58E-06
Benzo(g,h,i)perylene*		---	---	---	7.23E-05	8.13E-07	2.39E-06
Benzo(k)fluoranthene*		0.1	---	---	3.01E-05	3.39E-07	9.95E-07
Chrysene*		---	---	---	1.93E-04	2.17E-06	6.37E-06
Dibenzo(a,h)anthracene*		0.1	---	---	4.22E-05	4.75E-07	1.39E-06
Fluoranthene		50	15.4	---	5.06E-04	5.69E-06	1.67E-05
Fluorene		---	0.4	---	1.61E-03	1.81E-05	5.31E-05
Indo(1,2,3-cd)pyrene*		0.1	---	---	5.42E-05	6.10E-07	1.79E-06
Naphthalene		0.013	0.014	---	1.63E-02	1.84E-04	5.39E-04
Phenanthrene		0.046	0.11	---	5.13E-03	5.78E-05	1.70E-04
Pyrene		0.1	7.7	---	4.64E-04	5.22E-06	1.53E-05
Carcinogenic PAHs (sum of *BaP equivalent)		5.3		1.1	1.05E-04	1.18E-06	3.47E-06
Metals		Alberta	EcoSSL (plant)	EcoSSL (mammal)	MPOI	Cabin	Plateau
Aluminum	mg/kg	NR	NR	NR	---	---	---
Antimony		20	---	0.27	0.292	0.001	0.004
Arsenic		17	18	46	0.719	0.002	0.009
Barium		750	---	2000	42.204	0.142	0.530
Beryllium		5	---	21	0.228	0.001	0.003
Cadmium		3.8	32	0.36	0.306	0.001	0.004
Chromium		64	---	34 (CrIII)	2.509	0.008	0.032
Cobalt		20	13	230	2.099	0.007	0.026
Copper		63	70	49	6.616	0.022	0.083
Lead		70	12	56	3.125	0.011	0.039
Manganese		-	220	4000	---	---	---
Mercury		12	-	-	0.026	0.000	0.000
Molybdenum		4	-	-	0.479	0.002	0.006
Nickel		45	38	130	6.958	0.023	0.087
Selenium		1	0.52	0.63	0.278	0.001	0.003
Thallium		1	-	-	0.114	0.000	0.001
Uranium		33	-	-	0.456	0.002	0.006
Vanadium		130	-	280	9.125	0.031	0.115
Zinc	250	160	79	36.728	0.124	0.461	

NR – Not required as low toxic potential (US EPA, 2003)

Acid Deposition and vegetation health assessment

Exceedances of critical loads represent areas where effects of acidifying emissions may negatively affect the quality of forage for livestock on private property or within the provincial grazing reserves that were used extensively by cattle ranchers in the region. Figure *** shows the isopleths where exceedances of critical load, target load, or monitoring load occur. In general, the soil landscapes of the regional area have low to moderate sensitivity to acidification.

There were minor areas in the region that were predicted to have high sensitivity to acidification; however, none of these areas were predicted to receive exceedances of PAI to the critical, target, or monitoring critical load. The areas where exceedances to critical, target, or monitoring critical load were constrained to the 'moderate sensitivity' (yellow) on Figure 21. These areas fall both within and outside the planned mining leases of Isola, Isolation South, and Elan South. The areas where the potential for acid deposition exceeds the grid cell sensitivity ratings were concentrated in the planned Elan South mine in the coarse-textured glaciofluvial/fluvial/alluvial deposits in the valley bottoms. To verify the risk to terrestrial ecosystems due to acid deposition over the planned development case timeframe, site-specific soil survey and soil geochemical characterization is necessary.

There is an exceedance of the monitoring load and a potential exceedance of the critical load at the discrete receptor location LVST_F east of the Isola mining lease area. There were no other exceedances at discrete receptor locations (Figure 21) in the Planned Development Case.

Based on the results of the air dispersion/deposition modelling, there were no receptor-specific exceedances of the S critical level of 20 ug m^{-3} (annual mean). There were exceedances at the Maximum Point of Impingement (MPOI) in the 8760 hr model for NO-N ($0.03 \text{ ug m}^{-2} \text{ s}^{-1}$) and for NO₂-N ($0.27 \text{ ug m}^{-2} \text{ s}^{-1}$). Based on these exceedances, there could be other exceedances of the N deposition critical load at localized locations within the $0.17 \text{ keq ha}^{-1} \text{ yr}^{-1}$ isopleth (Figure 21).

In these areas, surface disturbance may or may not remove grazing land from the available rangeland base during the period of time when acid deposition would be anticipated to occur in the planned development case. It is understood that there were many areas where grazing would continue within the grazing allotments inside the mine site leases during the construction and operations of the mines. This means that grazing land will be exposed to PAI deposition greater than the monitoring load within and outside the boundaries of all of the mine sites in the region. Further study of critical loads and potential N and S deposition effects on vegetation directly within the $0.17 \text{ keq ha}^{-1} \text{ yr}^{-1}$ isopleth is required to better understand the likelihood and magnitude of impacts to grazing land because of PAI, N and S deposition.

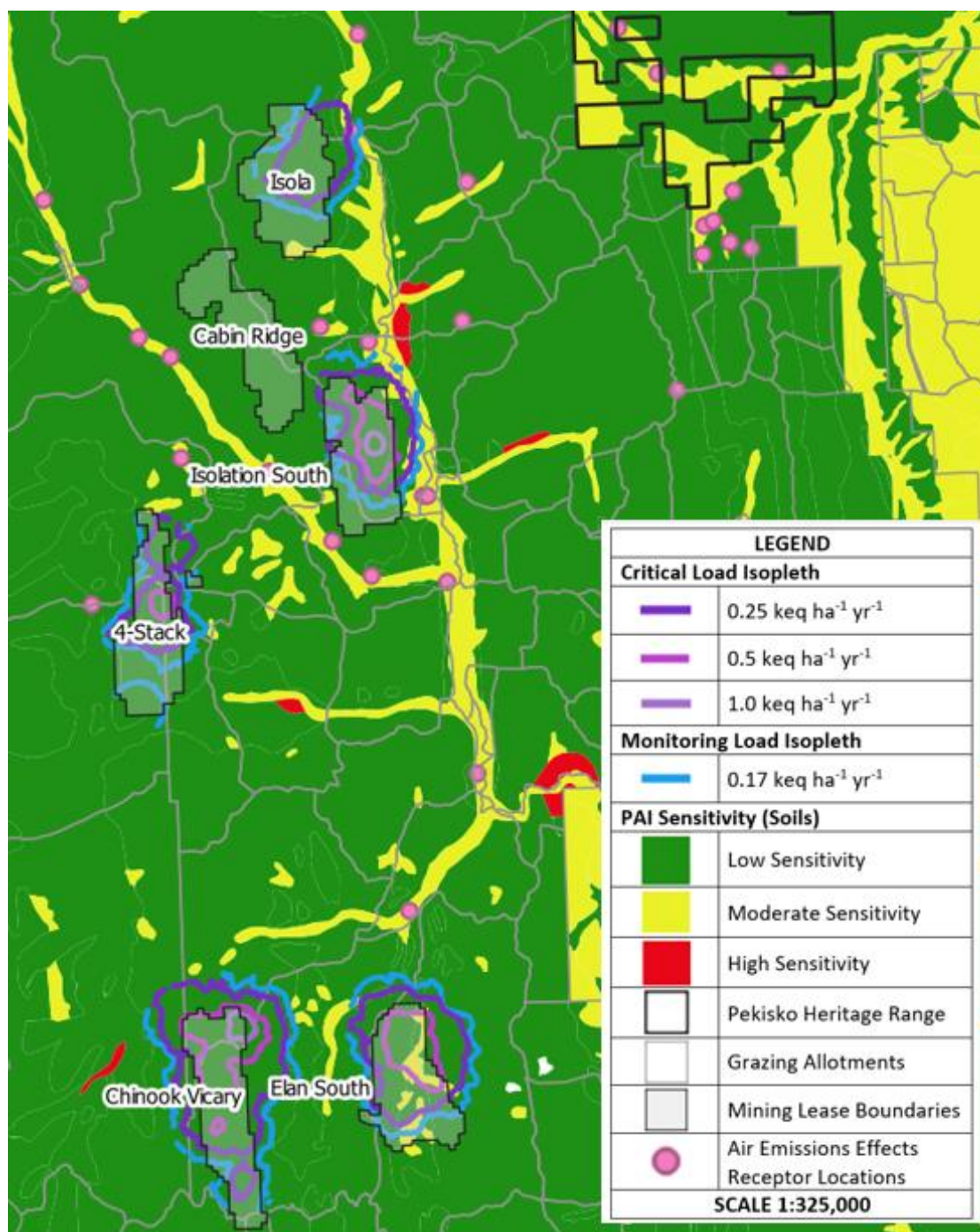


Figure 21. Critical Load Isopleths and 0.17 keq ha⁻¹ yr⁻¹ Monitoring Load Isopleth overlain on soil sensitivity to PAI (grid cell sensitivity ratings).

Health Risk Assessment

Detailed results of the human and livestock health risk assessment were provided in Appendices N and O.

A summary of risk levels associated with the PDC and baseline exposures for each receptor under the two dust suppression scenarios is provided below.

Under the PDC risks to forage crops from exposure to soils were not identified. However, the results of this assessment are limited by toxicity data which was available for 38% of the metals and PAHs assessed.

The greatest number of risks were predicted for cows consuming forage crops and through inhalation. The type and magnitude of risk varies depending on the dust suppression scenario and whether baseline soil concentrations were included, as shown in Tables 19 and 20. Fewer risks were predicted for nursing calves and local residents, compared to grazing cows.

Generally risks are related to metal deposition and inhalation as no risk were identified for exposures to carcinogenic and non-carcinogenic PAH groups (Appendix N and O).

Table 19. Predicted risks from exposure of plants, cattle and ranchers to metal and PAH emissions from the coal PDC case (no baseline).

Receptor	Location	Dust Suppression	Percent of COPCs assessed	Potential Risk Identified (Y/N)	COPC driving exposure risk
Plants	MPOI	50%	38%	N	N/A
		0%		N	N/A
	Cabin	50%		N	N/A
		0%		N	N/A
	Plateau Grazing	50%		N	N/A
		0%		N	N/A
Cattle (cow)	MPOI	50%	71%	Y	Antimony, Barium, Beryllium, Cadmium, Copper, Lead, Nickel, Selenium, Thallium, Vanadium, Zinc
		0%		Y	Antimony, Barium, Beryllium, Cadmium, Chromium, Cobalt , Copper, Lead, Nickel, Selenium, Thallium, Vanadium, Zinc
	Cabin	50%		N	N/A
		0%		N	N/A
	Plateau Grazing	50%		N	N/A
		0%		Y	Barium
Cattle (calf)	MPOI	50%	71%	Y	Barium, Beryllium, Copper, Nickel, Thallium, Zinc
		0%		Y	Barium, Beryllium, Copper, Nickel, Thallium, Vanadium , Zinc
	Cabin	50%		N	N/A
		0%		N	N/A
	Plateau Grazing	50%		N	N/A
		0%		N	N/A
Rancher (Adult)	MPOI	50%	100%	Y	Arsenic
		0%		Y	Arsenic
	Cabin	50%		N	N/A
		0%		N	N/A
	Plateau Grazing	50%		N	N/A
		0%		N	N/A
Rancher (Child)	MPOI	50%	100%	N	N/A
		0%		N	N/A
	Cabin	50%		N	N/A
		0%		N	N/A
	Plateau Grazing	50%		N	N/A
		0%		N	N/A

Bold indicates differences between 50% and 0% dust suppression scenarios.

Table 20. Predicted risks from exposure of plants, cattle and ranchers to metal and PAH emissions from the coal PDC and baseline soil conditions.

Receptor	Location	Dust Suppression	Percent of COPCs assessed	Potential Risk Identified (Y/N)	COPC driving exposure risk
Plants	MPOI	50%	38%	N	N/A
		0%		N	N/A
	Cabin	50%		N	N/A
		0%		N	N/A
	Plateau Grazing	50%		N	N/A
		0%		N	N/A
Cattle (cow)	MPOI	50%	71%	Y	Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Nickel, Selenium, Thallium, Vanadium, Zinc
		0%		Y	Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Nickel, Selenium, Thallium, Vanadium, Zinc
	Cabin	50%		Y	Antimony, Arsenic, Barium, Chromium, Copper, Lead, Nickel, Selenium, Thallium, Vanadium
		0%		Y	Antimony, Arsenic, Barium, Chromium, Copper, Lead, Nickel, Selenium, Thallium, Vanadium
	Plateau Grazing	50%		Y	Antimony, Arsenic, Barium, Beryllium, Chromium, Copper, Lead, Nickel, Selenium, Thallium, Vanadium, Zinc
		0%		Y	Antimony, Arsenic, Barium, Beryllium, Chromium, Copper, Lead, Nickel, Selenium, Thallium, Vanadium, Zinc
Cattle (calf)	MPOI	50%	71%	Y	Barium, Beryllium, Copper, Nickel, Thallium, Zinc
		0%		Y	Barium, Beryllium, Copper, Nickel, Thallium, Zinc
	Cabin	50%		N	N/A
		0%		Y	Thallium
	Plateau Grazing	50%		N	N/A
		0%		Y	Thallium
Rancher (Adult)	MPOI	50%	100%	Y	Arsenic (carcinogen)
		0%		Y	Arsenic (carcinogen)
	Cabin	50%		N	N/A
		0%		N	N/A
	Plateau Grazing	50%		N	N/A
		0%		N	N/A
Rancher (Child)	MPOI	50%	100%	N	N/A
		0%		N	N/A
	Cabin	50%		N	N/A
		0%		N	N/A
	Plateau Grazing	50%		N	N/A
		0%		N	N/A

Discussion

The following discussion provides context for the methods and results presented above.

Planned Development Case

Assumptions and limitations related to generating a planned development case for 7 mines which are not available were described in the methods section and could result in uncertainty when used to support the air dispersion modelling and subsequent effects assessments.

If the cumulative mine area for the seven proposed mine is larger than predicted, the air emissions also would be higher. The assumption that cumulative disturbed areas reported by Stelfox, B. and Donahue, B. (2021) and Chernos, M. et. al. (2021) are accurate representations of the Chinook Vicary, Elan South, Four-Stack, Isolation South, Cabin Ridge, and Isolation coal mines which do not have publicly available mine plans should be considered when interpreting the Report results.

Identifying air emissions sources for each of the proposed mines relied heavily on the air quality assessment completed for the Grassy Mountain Mine and any errors and limitations would be reproduced in this study (Millennium EMS, 2016). The generated cumulative mine scenario for the PDC only considered air emission sources and emission rates reported for the Grassy Mountain Mine and may or may not provide an accurate representation of mine operations depending on specific operations mine planning.

Regardless of uncertainties and limitations discussed above, the cumulative mine scenario and source emission file to support the air dispersion modelling were considered accurate representations of a planned development case for metallurgical coal mines in the Livingstone and Pekisko Heritage Range areas and adequate to support the air dispersion modelling and assessment of potential risks to forage crops, livestock and human health.

Air Dispersion Modelling

The air dispersion modelling relied on available information as the timeline for reporting. Baseline data from surface monitoring stations describing local meteorology and air quality in the study area was not available through the provincial monitoring network under the SSRP. The lack of local surface station data describing ground level wind speed and direction and concentration of air quality parameters associated with coal mine emissions was the primary limitation in the air dispersion modelling exercise.

The provincial MM5 data set relied on for modelling describes conditions in upper air levels with a significantly different ceiling height compared to ground level monitoring which occurs closer to the earths surface at surface monitoring stations. The differences in wind speed and direction between upper air levels (MM5 data) and ground level can be significant and affect the predicted dispersion of air contaminants (Government of Alberta, 2008).

Monitoring data describing wind speed and direction at local stations was identified within the Alberta wildfire monitoring network⁶ (Livingstone Gap (C1), Livingstone (CV) or Hailstone Butte (HB)) and a

⁶ Alberta surface monitoring station data available at: <https://acis.alberta.ca/weather-data-viewer.jsp>

comparison to MM5 data indicates the upper air data does not provide an accurate representation of ground level wind speeds or direction (Figure 10; Figure 22). Unfortunately, the Livingstone Gap and other local monitoring stations could not be used to support air modelling as required variables such as cloud cover were not measured (Personal Communications, Amy Thi, 2021).

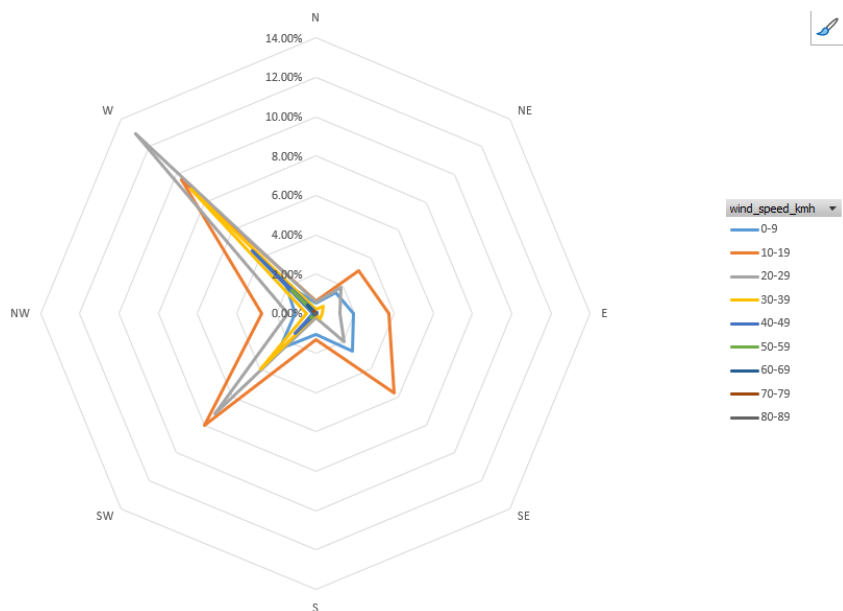


Figure 22. Wind rose generated from Livingstone Gap monitoring station accessed from <https://acis.alberta.ca/weather-data-viewer.jsp>.

The dispersion of air contaminants is correlated with wind speed and direction and inaccurate characterization of ground level conditions could limit the representativeness of predicted air dispersion to assess potential impacts to air quality within the study area and risks to exposed receptors. The lower average wind speed reported from the 2006 MM5 dataset (16.92 km/hr) could result in more localized dispersion of contaminants within the study area and elevated concentrations in these local areas.

The lack of local surface station monitoring data in the study area is limiting the accuracy of air modelling predictions and is required to support air dispersion modelling studies and assessments for future coal mine applications submitted for development in the Livingstone and Pekisko areas.

Air Quality Impacts from the Planned Development Case

Predicted concentrations of gaseous compounds (SO₂ and NO₂) and fugitive dust (PM_{2.5}, PM₁₀, TSP) from air emissions sources under the development scenario which assumed 8 simultaneously operating coal mines were detected across the study area. Generally, SO₂ and NO₂ were dispersed more broadly across the study area and particulate matter was elevated in closer proximity to the mine sites. This finding was expected as gaseous compounds with lower molecular weights may be transported further and transformed to a greater degree through atmospheric mechanisms prior to deposition as acid forming compounds.

Comparison of SO₂ to provincial, federal and global standards did not indicate exceedances of health-based thresholds and direct risks to humans from inhaling SO₂ emissions from cumulative coal mining

activities would be low. However, transformation of SO₂ to acid forming compounds is possible as discussed in the PAI and vegetation assessment.

Comparatively, NO₂ emissions from the coal mine PDC are higher than for SO₂ (Table 5) and health risks such as increased bronchitis and lung irritation (Table 21) from direct exposure and inhalation of NO₂ are more likely. Predicted hourly concentrations for the protection of respiratory health exceeded provincial, federal and global standards (Table 15) in close proximity to coal mine sites and at discrete receptor locations including a residential cabin, grazing allotments, Livingstone Falls, the Oldman River and two creeks (Racehorse and Maclay) (Appendix L; NO₂ isopleths).

It is important to interpret the predicted concentrations spatially as presented in the isopleths (Appendix L) to understand the intersection between planned coal mine development and existing land uses, specifically agriculture and ranching operations.

The NO₂ isopleths in Appendix L clearly identify that NO₂ emissions will be widespread over grazing allotments and recreational areas within the study area and are not limited to mining, although the highest concentrations are predicted closer to mine sites.

The mine sites intersect grazing allotments leased to local ranch operators (Rocking P Ranch, Plateau Cattle Co., Waldron and Spruce Community Associations) and the assumption that cattle and humans will not be within the areas overlaying or close to mines cannot be made, as is generally practice in project applications (Millenium EMS, 2016a,b,c).

Potential respiratory health impacts to local ranching families exposed to NO₂ under the PDC within the study area should be considered a key risk driver when considering development of coal mine leases in the Livingstone range.

Fugitive dust emissions from the PDC are also predicted to exceed health-based thresholds established by Canada and the World Health Organization for PM_{2.5} and PM₁₀ in close proximity to each of the mine sites as shown in Appendix L isopleths for each parameter. Table 21 summarizes the identified health impacts associated with exposure to small particulate matter (PM_{2.5}), specifically increased cardiovascular disease and early mortality. The risk of respiratory and cardiovascular effects in local ranchers operating in the areas above AAQOs, CAAQs, and WHO thresholds could be at risk from adverse effects associated with exposure to PM_{2.5} under the coal mining PDC. Given the limitations identified for air modelling and the efficacy of dust management this finding should be investigated further to understand the magnitude of PM_{2.5} emissions from coal mines and potential health risks in the study area.

The daily guideline for TSP was established to protect exposed populations against pulmonary effects such as decreased lung function (Table 21). Exceedances of the Alberta daily objective were predicted (Appendix L TSP isopleths) indicating that exposure to all sizes of particulate matter over short (hourly, daily) and long (annual) exposure periods are a potential risk factor to human health under the PDC for coal mines in the Livingstone area.

The health protection endpoint for objectives, guidelines, and standards identified in Table 1 were described in Table 21.

Table 21. Health protection goals for provincial, federal and global air quality objectives, guidelines, and standards.

COPCs	Exposure duration	Health Protection Goal		
		Provincial (AEP, 2019)	Federal (CCME CAAQS)	Global (WHO, 2018)
SO ₂	Hourly	Human health (Pulmonary function)	Human health	---
	Daily	Human health	---	Human health (Respiratory effects, decreased lung function, eye irritation, increased hospital admissions for cardiac disease and mortality)
	Monthly	Not provided	---	---
	Annual	Ecosystem health	---	---
NO ₂	Hourly	Human health (respiratory effects)	Human health	Human health (increases in bronchitis in asthmatic children)
	Daily	No threshold	---	---
	Monthly	No threshold	---	---
	Annual	Ecosystem health (vegetation)	---	Human health (increases in bronchitis in asthmatic children)
PM _{2.5}	Hourly	See Federal	---	---
	Daily	Health effects	Human health	---
	Monthly	---	---	Human health (Increased mortality or morbidity)
	Annual	---	Human health	---
TSP	Daily	Human health (pulmonary effects)	---	---
	Annual	Not provided	---	---

Exceedances of health-based inhalation thresholds were identified for predicted air concentrations of particulate bound arsenic, lead and nickel indicating local ranchers working and residing within the study area could be at risk from adverse health effects associated with exposure to each metal. Potential carcinogenic risks to adult ranchers from exposure to arsenic were also predicted in the risk assessment (Tables 19 and 20). The weight of evidence from these two lines indicates that potential respiratory effects and carcinogenicity from exposure to arsenic under the PDC is a risk factor to consider when assessing health impacts from development of coal mines in the Livingstone area.

Predicted concentrations of the following air contaminants were identified as potential risk factors that could contribute to deteriorated human and environmental health conditions specified as the protection goal for each contaminant over acute (short term) and chronic (long term) exposure periods related to air emissions from the coal mine PDC in the Livingstone area:

- Respiratory effects associated with Nitrogen dioxide concentrations (short- and long-term)
- Respiratory effects associated with larger diameter particulate matter (TSP and PM₁₀) concentrations (short and long term)
- Respiratory effects associated with particle bound arsenic concentrations (short term) and nickel and lead (long term)
- Cardiovascular effects associated with smaller diameter particulate matter concentrations (PM_{2.5} and PM₁₀) (long term)
- Soil acidification from deposition of sulphur and nitrogen acid compounds (further assessed in the vegetation health assessment)

Further investigation, beyond the scope of this Report, is required to understand the adverse health effects associated with the human health risk factors for each contaminant and exposure period. identified above.

Soil Quality Impacts from the Planned Development Case

Deposition of particulate bound antimony, cadmium, selenium, and naphthalene were predicted to exceed soil quality guidelines established for the protection of soil quality and the health of associated biota (invertebrates and plants) and connected media (surface water and groundwater).

Potential risks to forage/ grazing plants, livestock, and human (rancher) health from exposure to concentrations of each parameter exceeding soil quality guidelines was also assessed through the multi-media risk model discussed below. The weight of evidence between these two lines of enquiry indicates that direct health effects (such as decreased growth) to forage crops from metal exposures may be low but that bioaccumulation of metals by plants and ingestion by cattle was identified as a risk factor from the coal mine PDC.

Further investigation, beyond the scope of this study, is required to understand the potential impacts of the contaminants predicted to exceed soil quality guidelines to forage crop health given the results presented in Chernos, M. et. al. (2021) which predicted selenium contamination of surface water in the Livingstone range in under the PDC. Potential risks to plant health and soil microbes from these additional contributions of selenium from shallow groundwater (hydraulically connected to impacted surface water) could increase the mobilization of selenium into plants through root uptake mechanisms.

Risks to Cattle and Rancher Health from Inhalation and Ingestion Exposure Pathways

Potential risks to forage crop, livestock and human health from air contaminants released from the coal mine PDC were assessed through a multi-media risk model which estimates the uptake and movement of contaminants deposited to soil from plants to livestock and finally ranching families.

The risk model was developed to assess exposure of livestock and ranchers from two exposure pathways; inhalation of air contaminants and ingestion from a primary food source (forage crops for cows and beef

for humans) under two dust suppression scenarios (50% and 0% mitigation) and consideration of how baseline soil concentrations may contribute to risk.

Predicted concentrations of contaminants in air from the dispersion modelling were scaled for the appropriate dust suppression scenario and uncertainties identified in the air dispersion model would contribute to uncertainty in the risk assessment predictions.

Baseline air quality measurements were not available through the provincial monitoring network and the risk model considers contributions of metals and PAHs from existing development to be negligible. Baseline soil quality data was not available through provincial monitoring programs therefore the surface soil measurement for metals reported in the in Grassy Mountain Mine soil assessment were adopted (Millennium, EMS 2016b).

The lack of baseline monitoring data available under the SSRP monitoring network and other provincial programs for air and soil quality within the study area limits the applicability of the risk predictions and may underestimate potential health risks.

Two age classes were assessed for cattle (cow and calf) and ranchers (adult and child) to account for differences in diet, lifestyle characteristics, physical differences. The age classes and exposure durations align with the lifestyle and cattle operations of local ranching families which use grazing allotments in the Livingstone foothills to support cattle operations (Figure 3; Personal Communications Mac and Renie Blades and John Smith and Laura Laing).

Toxicity values to assess potential risks to cattle were limited and generic mammal-based health thresholds were often adopted. When a TRV could not be identified the potential risk could not be assessed.

The risk model and results do not provide an assessment of uptake, movement, or exposure to contaminants from ingestion of soil, water, fish, local country produce, or breast milk by nursing infants or dermal contact with soils or water. Further investigation of risks associated with exposure to contaminants under the coal mine PDC were beyond the scope of this study due to time and economic constraints and are required to understand potential health risks from development of coal mines in the Livingstone area.

As shown in Appendix N and O, elevated risks were identified when baseline concentrations of metals in soils were considered, however, the same metals were identified as potential risk factors whether baseline conditions were considered or not, when dust suppression was also accounted. The changes between the two scenarios are relate to the risk quotient (HQ or ILCR), which increased in the PDC plus baseline case with highest potential risks under the 0% dust suppression scenario.

Modifying the percent of dust suppression altered both the contaminants identified as risk factors and the risk quotients. Estimated HQs (for non-carcinogens) and ILCRs (for carcinogens) were higher when calculated for the 0% dust suppression scenario. This finding shows the importance of dust suppression as the primary management tool to decrease potential health risks from fugitive dusts emitted from metallurgical coal mines.

For the receptors and pathways assessed through the various dust suppression and baseline condition scenarios potential risks to cattle and resident health were identified (Tables 19 and 20) and summarized below for the worst-case scenario (no dust suppression), recognizing that some degree of dust suppression is likely to occur at operating metallurgical coal mines.

Potential risks to cattle (cows) from ingestion of forage crops at grazing allotments in the PDC were the highest identified risk factor and should be considered the primary risk driver when considering impacts to agricultural land uses. Potential risk to cows ingesting forage crops under the PDC when at the grazing allotments were identified for several metals: Antimony, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Nickel, Selenium, Thallium, Vanadium, Zinc. There were no predicted risks from exposure to PAHs deposited to soil from diesel exhaust emissions.

Potential risks from exposure to metals (Barium, Beryllium, Copper, Nickel, Thallium, Vanadium, Zinc) were also identified to nursing calves also ingesting forage crops at grazing allotments in the study area and developmental effects from exposure of calves to metals should be studied in future assessments.

Human health risk factors from inhalation of deteriorated air and ingestion of beef (cows foraging on grazing allotments in PDC) were identified for exposures to arsenic which exceeded the safe exposure thresholds over a lifetime for adult ranchers residing and working at two locations in the PDC; Blades Cabin (B_CABIN) and Plateau Mountain Grazing Allotment hold up area (PLATEAU_SW). Potential risks to children from the risk model scenario under the PDC were low. This is likely attributed to the differences in exposure and lifestyle characteristics for adult and children supporting ranching operations.

Differences in potential risks were also identified between the three locations assessed; MPOI (location with the highest predicted ground level concentration of TSP), Blades Cabin and Plateau Mountain hold up. Generally, estimated risk quotients and the number of parameters exceeding safe exposure levels were the highest at the MPOI location followed by Plateau and Blades cabin. Recognizing that ranching operations and cattle move freely within government issued grazing allotments it cannot be assumed that cattle and human receptors would not be present at on near the MPOI. The risk predictions for each of the three locations should be considered equally to understand potential health risks from the coal mine PDC in the Livingstone area.

Results presented here, based on the described methodologies, identify potential deterioration of air quality from NO₂ and particulate air emissions from the potential cumulative mining scenario which may include up to eight simultaneously operating metallurgical coal mines in the Livingstone and Pekisko area.

The identified deteriorated air quality conditions related to NO₂, PM_{2.5}, PM₁₀ and TSP (identified by comparison to provincial, federal, and global air quality guidelines, standards and objectives) were further predicted to deteriorate soil quality condition within the study area from deposition of particulate bound metals and naphthalene and acid forming compounds (see vegetation assessment).

The predicted deteriorations in air and soil conditions and uptake of metals by forage crops and exposure of cattle (cows and calves) and adult ranchers at grazing allotments under the coal mine PDC which considers 8 operating metallurgical coal mines (Grassy Mountain, Tent Mountain, Elan South, Isolation South, Cabin Ridge, Isola, Four-Stack, Chinook Vicary) could result in adverse chronic health effects cattle

herds and operations (at grazing allotments in the foothills Livingstone Range) and to lesser extent the health of local ranchers.

Risks to Grazing Pasture Health from Acid Deposition

There is an exceedance of the monitoring load and a potential exceedance of the critical load at the discrete receptor location LVST_F east of the Isola mining lease area. There were no other exceedances at discrete receptor locations Figure 21 in the Planned Development Case. There were potentially localized exceedances of critical loads of acidity for soil within Grazing Allotments within and in the vicinity of the Elan South, Isola and Isolation South mine lease areas in the Planned Development Case. Further study is necessary in order to determine the critical loads for soils assessed as moderately sensitive within the $0.17 \text{ keq ha}^{-1} \text{ yr}^{-1}$ isopleth. As the MPOI peak concentrations for SO_2 falls below the recommended critical level in the 8760 hr model, it is highly unlikely that vegetation will experience sulphur toxicity or sulphur-induced nutrient deficiencies as result of S deposition in the Planned Development Case.

Conversely, the exceedances of NO-N and $\text{NO}_2\text{-N}$ the MPOI in the 8760 hr model suggest that localized impacts to grazing quality may occur in the Planned Development Case. Further study and modelling is necessary to delineate the geographical extent of exceedance of the N critical load for direct deposition on vegetation. Additionally, there is a large degree of uncertainty in the species-specific sensitivity to N deposition. Work conducted by Lovett (2013) suggests that many species in north America have critical loads for N deposition that were “very low”.

The risks of soil acidification and resultant consequence to the terrestrial ecosystem is low in the region due to the high buffering capacity of the limestone-derived and calcareous soils in the region. Despite this, the direct deposition of N on vegetation still presents a risk to grazing quality and quantity. It is common knowledge that N inherently is a critical macronutrient, and the notion that low levels of N deposition would have a negative, rather than positive, effect on vegetation seems counter-intuitive. The issue with N deposition, even as an input of ‘fertilizer’ to natural ecological communities, is that each vegetation species interacts uniquely with differing inputs of N that were previously in equilibrium. The competition dynamics between species changes in these circumstances and can result in species composition changes in the ecosystem that could have the effect of degrading forage quality within the grazing allotments within the $0.17 \text{ keq ha}^{-1} \text{ yr}^{-1}$ isopleth (Verma and Sagar 2020; APIS 2016; Wen-Juan et al. 2019; Bobbink et al 2013; Lovett 2013; Reinds et al 2008). The hazard of these effects increases with N deposition (generally and simplistically, increasing PAI isopleth on Figure 21).

A key ancillary consequence to species composition/biodiversity changes that could occur due to N deposition is impairment of resilience to ecological stressors; namely, drought. The cattle ranching industry is susceptible to drought conditions, which were expected to occur at a greater frequency and severity due to climate change over the coming decades. Financial consequences to cattle ranching due to the combined impacts of decreased forage quality, impaired ecosystem resilience, and climate-change-induced drought severity, were therefore a plausible outcome of intensive coal mining in the region.

Recommendations

The following recommendations have been identified in addition to those described throughout the report.

Baseline Monitoring Data

Provincial monitoring data is required to establish the existing condition of air and soil quality in areas where metallurgical coal mine developments are proposed in the Livingstone area. The lack of monitoring data is limiting the accuracy and applicability of air dispersion modelling studies and assessment of potential risks.

Risks to Agricultural land uses and human health

The study presented here provides an indication of the potential impacts to air quality and risks to agricultural land use (ranching operations) and users (ranching families) in the Livingstone range. Future studies are required to validate the assumptions and uncertainties identified in this report and to support a more thorough assessment of the potential impacts to water quality from coal mine developments and the associated risks to forage crops, cattle, and residents in the Livingstone area. It is recommended that these studies be completed prior to policy and development decisions to ensure the land does not become unusable for the predominant industry in the area, which is currently agriculture.

It is recommended that the provincial government undertake an assessment of potential health impacts from metallurgical coal mine development in the Eastern Slopes that is supported by the departments responsible for developing policy and regulating development. Specifically, Alberta Health, Alberta Agriculture, Alberta Environment and Parks, and the Alberta Energy Regulator must consider the published scientific and monitoring data related to health impacts from metallurgical coal mine developments in other jurisdictions (Australia, United States) and integrate these into assessments to support the development of future policy and regulations in Alberta.

Risks to Grazing Pasture Health from Acid Deposition

Further study is required to quantify and validate the critical load values for soils in the area of the planned developments. In the absence of site-specific soil geochemical characterization and critical load determination, qualitative and/or pseudo-quantitative models based on literature and regional surficial geology/soils mapping provide the only alternative. Acid deposition risk is generally very low (or negligible) for the majority of the region due to the prevalence of limestone bedrock and calcareous surficial deposits. Further study should therefore be focused in areas within the $0.17 \text{ keq ha}^{-1} \text{ yr}^{-1}$ isopleth that contain coarse-textured, well-drained, non-calcareous parent materials (i.e., glaciofluvial/fluvial/alluvial deposits of sandstone or Laurentide ice sheet deposits).

Further study on the species-level sensitivity of high-quality forage ecological communities (and delineation of their geographical extent) is needed to understand the impacts of coal development on grazing pasture health in the region. There were existing publicly available publications and resources that may allow for such a study to be completed as a desktop analysis and could be integrated with the results of the N deposition modelling conducted as part of this assessment.

It is recommended that policy-makers conduct an evaluation of the potential impacts to the cattle ranching industry located in the area of the Planned Development Case as a result of the cumulative

effects due to N deposition. The scope of such an evaluation should include addressing the data gaps and uncertainties of ecological community sensitivity to N deposition presented in this assessment.

Closing

This report was prepared using best professional judgement and the authors have exercised reasonable skill, care, and diligence to assess the information acquired during the preparation of this report but make no guarantees or warranties as to the accuracy or completeness of this information. The information contained in this report is based upon, and limited by, the circumstances and conditions acknowledged herein, and upon information available at the time of its preparation. The information provided by others is believed to be accurate but cannot be guaranteed.

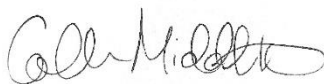
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Sincerely,



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Appendix A. CALPUFF Model Options

Table A.1 Allowed Non-default and/or Alternate Model Options for CALPUFF

Model Option	Recommended AEP AQMG ^(a)	Applied Guideline	Comments
CALMET			
I PROG	14	14	-
IRH PROG	1	1	-
IT PROG	2	2	NOOBS = 2
IWFCOD	1	1	-
IXTERP	1	1	NOOBS = 2
MCLOUD	4	4	Cloud cover derived from the AEP provided meteorological data
NOOBS	2	2	AEP provided meteorological data only
R1,R2		Not Applicable	
RMAX1		Not Applicable	
TERRAD	-	5 km	No major terrain influences, assumed flat
TRADKM	-	24	Twice the resolution of AEP provided meteorological data set
ZFACE		0., 20., 40., 80., 120., 280., 520., 880., 1320., 1820., 2380., 3000., 4000.	
CALPUFF			
MBDW	2	2	Prime algorithm downwash
MCHEM	1 or 3	3	RIVAD chemistry
MDISP	2	2	-
MPDF	1	1	To match MDISP setting
MPARTLBA	1	1	Allows for partial penetration of plume
MREG	0	0	Waive regulatory check
MOZ	-	1	Recommended rural ozone (AEP, 2013)
MTIP	-	N/A	-

^(a) Recommended guideline from AEP, 2013

Table A.2. Terrain characteristics

Int_Category	z0	Albedo	owen_Ratio	Heat_Flow	ogenic_Hef_Area_Incut_Category	Description	Color_R	Color_G	Color_B
11	0.5	0.18	1.5	0.2	0	10 Residential	198	182	255
12	1	0.18	1.5	0.25	0	10 Commercial	255	150	148
13	1	0.18	1.5	0.25	0	10 Industrial	222	0	24
14	1	0.18	1.5	0.25	0	10 Transportation	222	0	24
15	1	0.18	1.5	0.25	0	10 Industrial area	222	0	24
16	1	0.18	1.5	0.25	0	10 Mixed Urban	255	150	148
17	1	0.18	1.5	0.25	0	10 Other Urban	255	150	148
21	0.25	0.15	1	0.15	0	20 Cropland and	255	255	189
22	0.25	0.15	1	0.15	0	20 Orchards, Vine	255	255	189
23	0.25	0.15	1	0.15	0	20 Confined Pasture	255	255	189
24	0.25	0.15	1	0.15	0	20 Other Agriculture	255	255	189
31	0.05	0.25	1	0.15	0	30 Herbaceous	198	255	189
32	0.05	0.25	1	0.15	0	30 Shrub and	181	158	0
33	0.05	0.25	1	0.15	0	30 Mixed Range	181	158	0
41	1	0.1	1	0.15	0	40 Deciduous	33	97	16
42	1	0.1	1	0.15	0	40 Evergreen	57	231	0
43	1	0.1	1	0.15	0	40 Mixed Forest	57	231	0
51	0.001	0.1	0	1	0	51 Streams and	0	255	255
52	0.001	0.1	0	1	0	51 Lakes	0	255	255
53	0.001	0.1	0	1	0	51 Reservoirs	0	255	255
54	0.001	0.1	0	1	0	54 Bays and Estuaries	0	255	255
55	0.001	0.1	0	1	0	55 Oceans and	0	64	128
61	1	0.1	0.5	0.25	0	61 Forested Wetland	33	97	16
62	0.2	0.1	0.1	0.25	0	62 Nonforested Wetland	132	166	8
71	0.05	0.3	1	0.15	0	70 Dry Salt Flats	148	81	24
72	0.05	0.3	1	0.15	0	70 Beaches	148	81	24
73	0.05	0.3	1	0.15	0	70 Sandy Areas	148	81	24
74	0.05	0.3	1	0.15	0	70 Bare Exposed	148	81	24
75	0.05	0.3	1	0.15	0	70 Strip Mines	148	81	24
76	0.05	0.3	1	0.15	0	70 Transitional	148	81	24
77	0.05	0.3	1	0.15	0	70 Mixed Barren	148	81	24
81	0.2	0.3	0.5	0.15	0	80 Shrub and	128	128	128
82	0.2	0.3	0.5	0.15	0	80 Herbaceous	128	128	128
83	0.2	0.3	0.5	0.15	0	80 Bare Ground	128	128	128
84	0.2	0.3	0.5	0.15	0	80 Wet Tundra	128	128	128
85	0.2	0.3	0.5	0.15	0	80 Mixed Tundra	128	128	128
91	0.05	0.7	0.5	0.15	0	90 Perennial Snow	255	255	255
92	0.05	0.7	0.5	0.15	0	90 Glaciers	255	255	255

Table A.3 Discrete receptor locations

ID_Receptor	Easting (m)	Northing (m)
CARTWRT	690147.4	5588004
CHIMNEY	696433.1	5548250
BB_RANCH	695826.4	5573604
RH_CRK	685317.1	5523281
CTRT_CRK	672366.7	5573601
OLDM_RF	672826.5	5547071
LVST_F	683129	5552896
PLT_MC	683367.8	5556613
C_GARDN	695847.5	5573639
S_GARDN	696699	5576380
RLND_MB	700644.7	5564963
R_BLAKE	694710.8	5555109
B_RANSOM	693212.3	5556837
RCKP_PLC	699359.1	5555177
S_HARVEY	697429.1	5548723
R_DAVIS	697558.2	5550639
RESIDEN	696455.8	5549347
COCHLAN	696808.1	5549509
N_RCKP	683775.5	5544941
NW_RCKP	671413.9	5550313
S_RCKP	686731.3	5535803
E_RCKP	695443.8	5543061
W_RCKP	676653.7	5540480
WLDRN_N	704966.2	5535606
WLDRN_S	705908.1	5523353
BOB_BNB	697211.9	5528847
BLADE_R	704993.9	5580872
LVG_GAP	687858.5	5528529
OM_RVR	683841.4	5536050
ATRM_EN	682393.2	5537347

Appendix B. Source Emission Estimates

Table B.1: Grassy Mountain maximum daily diesel fuel combustion emissions based on activity category.

	SO ₂ (kg/d)	NO _x (kg/d)	PM _{2.5} (kg/d)
Coal Mining	0.8	164	1.9
Waste Removal	2.7	640	7.3
Haul Road	4.1	846	10
Disposal area	1.9	483	5.4
Reclamation	0.1	2.4	0.1
Plant	0.7	187	2.1
Train Loadout	0.2	7.1	0.1
Blasting	7.1	394	-
Total	17.6	2724	27

Table B.2: Grassy Mountain maximum daily diesel fuel combustion emissions allocated to operation areas.

Grassy Mountain Operations Area	SO ₂ (kg/d)	NO _x (kg/d)	PM _{2.5} (kg/d)
Clean Stockpile	0.35	93.50	1.05
Coal Hauling Road 1	0.82	169.20	2.00
Coal Hauling Road 2	0.82	169.20	2.00
Coal Mine Area 1	0.40	82.00	0.95
Coal Mine Area 2	0.40	82.00	0.95
Drilling Area 1	3.55	197.00	-
Drilling Area 2	3.55	197.00	-
North Dump	0.95	241.50	2.70
North Dump Hauling Road	0.82	169.20	2.00
Rail Load Out	0.20	7.10	0.10
Reclamation Area	0.10	2.40	0.10
ROM Stockpile	0.35	93.50	1.05
South Dump	0.95	241.50	2.70
South Dump Hauling Road 1	0.82	169.20	2.00
South Dump Hauling Road 2	0.82	169.20	2.00
Waste Strip Area 1	0.90	213.33	2.43
Waste Strip Area 2	0.90	213.33	2.43
Waste Strip Area 3	0.90	213.33	2.43
Total	17.6	2723.5	26.9

Table B.3: Grassy Mountain maximum daily fugitive dust emissions based on activity category.

	PM _{2.5} (kg/d)	PM ₁₀ (kg/d)	TSP (kg/d)
Coal Mining	5	29	83
Waste Removal	21	96	252
Haul Road	640	2556	10251
Disposal area	7.6	32	89

Reclamation	2.6	13	39
Plant	2.7	54	139
Train Loadout	0.3	7.6	16
Blasting	1.1	19	37
Total	680	2,807	10,906

Table B.4: Grassy Mountain maximum daily fugitive dust emissions allocated to operation areas.

Grassy Mountain Operations Area	PM_{2.5} (kg/d)	PM₁₀ (kg/d)	TSP (kg/d)
Clean Stockpile	1.35	27.00	69.50
Coal Hauling Road 1	128.00	511.20	2050.20
Coal Hauling Road 2	128.00	511.20	2050.20
Coal Mine Area 1	2.50	14.50	41.50
Coal Mine Area 2	2.50	14.50	41.50
Drilling Area 1	0.55	9.50	18.50
Drilling Area 2	0.55	9.50	18.50
North Dump	3.80	16.00	44.50
North Dump Hauling Road	128.00	511.20	2050.20
Rail Load Out	0.30	7.60	16.00
Reclamation Area	2.60	13.00	39.00
ROM Stockpile	1.35	27.00	69.50
South Dump	3.80	16.00	44.50
South Dump Hauling Road 1	128.00	511.20	2050.20
South Dump Hauling Road 2	128.00	511.20	2050.20
Waste Strip Area 1	7.00	32.00	84.00
Waste Strip Area 2	7.00	32.00	84.00
Waste Strip Area 3	7.00	32.00	84.00
Total	680	2,807	10,906

Appendix C. Emission profile for air sources in planned development case

Appendix D. Model Validation - Comparison of Predicted to Reported Concentrations

Table D.1: Comparison of validation modelling predictions and Grassy Mountain project air quality predictions for ambient SO₂ concentrations

Average Period	Metric	Receptor Location	SO ₂ Peak Concentration including Background (µg/m ³)	Grassy Mountain Air Quality Prediction (µg/m ³)	% difference
1-HOUR	99.9 %ile	R1	4.4	4.8	8%
1-HOUR	99.9 %ile	R2	3.1	3.6	14%
1-HOUR	99.9 %ile	R3	3.2	4	21%
1-HOUR	99.9 %ile	R4	2.7	3.1	14%
1-HOUR	99.9 %ile	R5	2.7	3.2	14%
1-HOUR	99.9 %ile	R6	4.0	4.3	7%
1-HOUR	99.9 %ile	R7	3.7	3.8	4%
1-HOUR	99.9 %ile	R8	4.5	6.8	33%
1-HOUR	99.9 %ile	R9	3.5	3.7	4%
1-HOUR	99.9 %ile	R10	6.5	9.8	33%
1-HOUR	99.9 %ile	R11	7.0	8.9	21%
1-HOUR	99.9 %ile	R12	3.6	5.8	38%
1-HOUR	99.9 %ile	R13	4.2	7.8	46%
1-HOUR	99.9 %ile	R14	5.6	8.3	33%
1-HOUR	Max	R1	4.8	4.5	-6%
1-HOUR	Max	R2	3.2	2.9	-11%
1-HOUR	Max	R3	3.2	3.3	3%
1-HOUR	Max	R4	2.7	2.8	4%
1-HOUR	Max	R5	2.8	2.8	-1%
1-HOUR	Max	R6	4.2	4.1	-2%
1-HOUR	Max	R7	3.8	3.6	-6%
1-HOUR	Max	R8	5.0	6.2	20%
1-HOUR	Max	R9	3.8	3.3	-14%
1-HOUR	Max	R10	7.7	4.6	-66%
1-HOUR	Max	R11	8.2	4.6	-78%
1-HOUR	Max	R12	3.8	3	-27%
1-HOUR	Max	R13	4.8	3.6	-32%
1-HOUR	Max	R14	6.2	7.5	18%
24-HOUR	Average	R1	2.6	3.2	19%
24-HOUR	Average	R2	2.2	2.2	0%
24-HOUR	Average	R3	2.3	2.4	5%
24-HOUR	Average	R4	2.1	2.1	-1%
24-HOUR	Average	R5	2.1	2.1	-2%
24-HOUR	Average	R6	2.6	3.2	18%
24-HOUR	Average	R7	2.4	2.7	12%
24-HOUR	Average	R8	2.7	4.1	34%
24-HOUR	Average	R9	2.4	2.3	-4%
24-HOUR	Average	R10	3.0	2.4	-24%
24-HOUR	Average	R11	3.0	2.4	-26%
24-HOUR	Average	R12	2.3	2.2	-4%
24-HOUR	Average	R13	2.4	2.2	-11%
24-HOUR	Average	R14	3.5	4.4	20%

8760-HOUR	Average	R1	1.0	1.1	11%
8760-HOUR	Average	R2	0.9	0.9	-1%
8760-HOUR	Average	R3	0.9	0.9	-3%
8760-HOUR	Average	R4	0.9	0.9	0%
8760-HOUR	Average	R5	0.9	0.9	0%
8760-HOUR	Average	R6	1.1	1.2	8%
8760-HOUR	Average	R7	1.0	1.1	8%
8760-HOUR	Average	R8	1.0	1.5	30%
8760-HOUR	Average	R9	0.9	0.9	-3%
8760-HOUR	Average	R10	1.0	0.9	-13%
8760-HOUR	Average	R11	1.0	0.9	-9%
8760-HOUR	Average	R12	0.9	0.9	-3%
8760-HOUR	Average	R13	1.0	0.9	-6%
8760-HOUR	Average	R14	1.18199	1.6	26%

Table D.2: Comparison of validation modelling predictions and Grassy Mountain project air quality predictions for ambient NO₂ concentrations

Average Period	Percentile	Receptor Location	NO2 Peak Concentration including Background (µg/m ³)	Grassy Mountain Air Quality Prediction (µg/m ³)	% difference
1-HOUR	99.9 %ile	R1	88.4	89	1%
1-HOUR	99.9 %ile	R2	67.8	61	-11%
1-HOUR	99.9 %ile	R3	62.6	89	30%
1-HOUR	99.9 %ile	R4	31.1	49	37%
1-HOUR	99.9 %ile	R5	38.4	53	27%
1-HOUR	99.9 %ile	R6	73.1	96	24%
1-HOUR	99.9 %ile	R7	74.1	87	15%
1-HOUR	99.9 %ile	R8	78.8	109	28%
1-HOUR	99.9 %ile	R9	164.4	94	-75%
1-HOUR	99.9 %ile	R10	419.6	91	-361%
1-HOUR	99.9 %ile	R11	363.7	92	-295%
1-HOUR	99.9 %ile	R12	163.8	76	-116%
1-HOUR	99.9 %ile	R13	233.2	78	-199%
1-HOUR	99.9 %ile	R14	94.0	94	0%
1-HOUR	Max	R1	100.3	92	-9%
1-HOUR	Max	R2	77.5	88	12%
1-HOUR	Max	R3	68.3	95	28%
1-HOUR	Max	R4	32.7	72	55%
1-HOUR	Max	R5	46.4	85	45%
1-HOUR	Max	R6	82.1	102	19%
1-HOUR	Max	R7	81.7	94	13%
1-HOUR	Max	R8	85.5	130	34%
1-HOUR	Max	R9	179.0	101	-77%
1-HOUR	Max	R10	533.9	122	-338%
1-HOUR	Max	R11	450.0	110	-309%
1-HOUR	Max	R12	185.0	87	-113%
1-HOUR	Max	R13	275.8	105	-163%
1-HOUR	Max	R14	105.0	97	-8%
8760-HOUR	Average	R1	14.5	25	42%
8760-HOUR	Average	R2	11.7	17	31%
8760-HOUR	Average	R3	13.8	25	45%
8760-HOUR	Average	R4	11.1	17	35%
8760-HOUR	Average	R5	11.3	17	34%
8760-HOUR	Average	R6	16.1	36	55%
8760-HOUR	Average	R7	15.7	29	46%
8760-HOUR	Average	R8	15.6	43	64%
8760-HOUR	Average	R9	15.4	21	27%
8760-HOUR	Average	R10	25.5	28	9%
8760-HOUR	Average	R11	17.7	19	7%
8760-HOUR	Average	R12	15.1	21	28%
8760-HOUR	Average	R13	20.7	20	-3%
8760-HOUR	Average	R14	16.6	35	52%

Table D.3: Comparison of validation modelling predictions and Grassy Mountain project air quality predictions for ambient PM_{2.5} concentrations

Average Period	Percentile	Receptor Location	PM _{2.5} Peak Concentration including Background (µg/m ³)	Grassy Mountain Air Quality Prediction (µg/m ³) based on Table ECCC-R2-5-1 50% dust reduction efficiency	% difference
24-HOUR	98%ile	R1	11.8	12.2	3%
24-HOUR	98%ile	R2	8.4	7.6	-10%
24-HOUR	98%ile	R3	10.0	9.8	-2%
24-HOUR	98%ile	R4	7.1	7	-1%
24-HOUR	98%ile	R5	7.3	7.2	-2%
24-HOUR	98%ile	R6	14.0	16	13%
24-HOUR	98%ile	R7	11.1	11.2	1%
24-HOUR	98%ile	R8	12.7	18.8	32%
24-HOUR	98%ile	R9	21.3	9.2	-131%
24-HOUR	98%ile	R10	40.2	13.5	-197%
24-HOUR	98%ile	R11	13.6	10.2	-34%
24-HOUR	98%ile	R12	17.3	8.1	-113%
24-HOUR	98%ile	R13	25.7	8.5	-203%
24-HOUR	98%ile	R14	15.0	18.3	18%
24-HOUR	Max	R1	13.5	not available	n/a
24-HOUR	Max	R2	10.2	not available	n/a
24-HOUR	Max	R3	11.5	not available	n/a
24-HOUR	Max	R4	7.5	not available	n/a
24-HOUR	Max	R5	7.7	not available	n/a
24-HOUR	Max	R6	15.8	not available	n/a
24-HOUR	Max	R7	12.0	not available	n/a
24-HOUR	Max	R8	13.9	not available	n/a
24-HOUR	Max	R9	28.2	not available	n/a
24-HOUR	Max	R10	55.8	not available	n/a
24-HOUR	Max	R11	19.2	not available	n/a
24-HOUR	Max	R12	22.6	not available	n/a
24-HOUR	Max	R13	33.5	not available	n/a
24-HOUR	Max	R14	21.2	not available	n/a
8760-HOUR	Average	R1	4.9	5.3	8%
8760-HOUR	Average	R2	4.2	4.1	-2%
8760-HOUR	Average	R3	4.6	4.8	4%
8760-HOUR	Average	R4	4.0	4	-1%
8760-HOUR	Average	R5	4.1	4	-2%
8760-HOUR	Average	R6	6.9	7.5	8%
8760-HOUR	Average	R7	5.7	5.5	-3%
8760-HOUR	Average	R8	5.6	8.8	36%
8760-HOUR	Average	R9	6.0	4.5	-33%
8760-HOUR	Average	R10	13.8	6.4	-116%
8760-HOUR	Average	R11	5.1	4.5	-12%
8760-HOUR	Average	R12	5.8	4.3	-35%
8760-HOUR	Average	R13	8.6	4.4	-96%
8760-HOUR	Average	R14	6.5	8.2	20%

Appendix E. Soil Series Risk Ratings

Soil Acidification Relative Risk Ratings Appendix

Table E-1. Soil Series Relative Risk Ratings to Acid Deposition in SCAs 5, 8, and 16 (eastern portion of the air dispersion/deposition modelling domain).

Soil Name	Soil Taxonomy	Pwerent Material	Pwerent Material Texture	Relative Risk Rating
WATERTON	O.HFP	COLL	M1	High
BEAUVAIS	O.DGC	TILL	M4	Moderate-High
LUNDBRECK	O.BLC	GLFL	C1	Moderate-High
SPRUCE RIDGE	O.GL	TILL	M4	Moderate-High
WESTCASTLE	O.GL	TILL	M6	Moderate-High
BELLEVUE	O.DBC	COLL/SRUN	L19	Moderate
BURMIS	R.BLC	GLFL	C1	Moderate
CARWAY	O.BLC	GLFL	C3	Moderate
CAW	CU.HR	COLL/BRUN	L8	Moderate
CONNOP	E.EB	GLFL	C3	Moderate
DRYWOOD	O.BLC	GLFL	L5	Moderate
FRANK	O.EB	COLL	M1	Moderate
GHOST	CA.DGC	GLFL	C3	Moderate
KNIGHT	O.BLC	GLFL	C3	Moderate
LONELY VALLEY	O.BLC	GLFL	C3	Moderate
MCGILLVARY	E.EB	GLFL	C1	Moderate
MESA BUTTE	O.BLC	COLL/SRUN	L8	Moderate
MORLEY	O.DGC	GLFL	C1	Moderate
RINARD	O.BLC	GLFL	C1	Moderate
SHARP HILLS	R.BLC	GLFL	C3	Moderate
SKYLINE	E.EB	SRUN	C6	Moderate
WILLOUGHBY	E.DYB	TILL	M6	Moderate
BEAUPRE	O.EB	TILL	M4	Low-Moderate
BLACKFOOT	O.BLC	FLUV/GLFL	L5	Low-Moderate
BRAGG CREEK	E.EB	GLFL	L5	Low-Moderate
CARBONDALE	O.EB	TILL/BRUN	L6	Low-Moderate
CROOKED CREEK	D.GL	TILL/SRCN	L6	Low-Moderate
DARNELL	TY.M	FNPT	P2	Low-Moderate
DEL BONITA	O.BLC	EOLI	M2	Low-Moderate
ELBOW	D.GL	GLLC	F1	Low-Moderate
ELBOW	D.GL	GLLC	F1	Low-Moderate
HILLMER	O.BLC	FLUV	M2	Low-Moderate
LEIGHTON CENTRE	D.GL	TILL	M4	Low-Moderate

MITFORD	T.M	FNPT/TILL	L12	Low-Moderate
NORTH FORK	O.EB	TILL/BRUN	L6	Low-Moderate
OUTPOST	O.BLC	GLFL	M1	Low-Moderate
PORCUPINE	O.BLC	COLL	M2	Low-Moderate
POTHOLE CREEK	O.HG	GLLC	F1	Low-Moderate
ROBINSON	D.GL	TILL	F4	Low-Moderate
ROCKFORD	O.BLC	GLFL	M1	Low-Moderate
SAKALO	O.BLC	GLLC/GLFL	L18	Low-Moderate
SARCEE	O.BLC	FLUV	M2	Low-Moderate
TODD CREEK	GL.DGC	FLUV	L5	Low-Moderate
TOUGH CREEK	O.GL	TILL/SRCN	L6	Low-Moderate
TWIN BRIDGES	GL.HR	FLUV	C3	Low-Moderate
WOLLIM	R.DBC	GLFL/TILL	L1	Low-Moderate
BEAZER	O.BLC	TILL	M4	Low
BIRDSEYE	O.DGC	TILL/SRUN	L6	Low
BULLHORN	SZ.BLC	GLLC	M3	Low
CARDSTON	O.BLC	GLLC/SRUN	L16	Low
COWLEY	CA.BLC	GLLC	F3	Low
CROWLODGE	BL.SO	GLLC	F1	Low
DUNVARGAN	O.BLC	TILL	M4	Low
FISH CREEK	O.BLC	GLLC	F1	Low
HATFIELD	O.BLC	TILL/SRUN	L6	Low
JOANTO	R.HG	LACU	F1	Low
KLEMENGURT	BL.SZ	GLLC	F1	Low
MAMI	BL.SZ	TILL	M4	Low
MAYCROFT	O.BLC	GLLC	M3	Low
MOKOWAN	O.R	SRUN	M5	Low
NINASTOKO	BL.SS	TILL	M4	Low
OCKEY	O.BLC	TILL/SRUN	L6	Low
OLDMAN	R.BLC	GLLC	M3	Low
OWENDALE	O.BLC	SRUN	M5	Low
OXLEY	BL.SZ	SRUN	M5	Low
PARSONS	R.BLC	TILL	M4	Low
PEIGAN	BL.SS	GLLC	F1	Low
PINCHER	O.BLC	GLLC	F1	Low
RED DEER LAKE	GLBL.SS	GLLC	M3	Low
SHANDOR	O.BLC	FLUV/BRUN	F1	Low
SPY HILL	O.BLC	TILL	M6	Low
STANDOFF	O.BLC	GLLC	M3	Low
WILDCAT	HU.LG	GLLC/TILL	L3	Low

Table E-2. Soil Series Relative Risk Ratings to Acid Deposition in British Columbia in the west portion of the air dispersion/deposition modelling domain

Soil Name	Soil Taxonomy	Parent Material Type	Relative Risk Rating
ABRUZZI	O.GL	GLLC	Low
ANTHROPOGENIC	-	ANTH	Low-Moderate
BADSHOT	O.EB	COLL	Low-Moderate
BRENNAN	O.DYB	COLL	Moderate-High
BUNYON	O.HFP	COLL	Moderate-High
CALDEROL	O.DYB	COLL	Moderate-High
COAL CREEK	O.EB	COLL	Low-Moderate
COKATO	O.DYB	TILL	Moderate
COLUMBINE	O.HFP	COLL	Moderate
CONRAD	O.HFP	COLL	Moderate-High
COOPER	O.DYB	COLL	Moderate-High
CORBIN	O.DYB	COLL	Moderate-High
CORNWELL	O.EB	COLL	Low-Moderate
CORRIGAN	O.HFP	COLL	Moderate-High
COUBREY	O.DYB	COLL	Moderate-High
COULDRON	O.EB	COLL	Low-Moderate
COULOTTE	O.EB	COLL	Low-Moderate
CROSSING	O.HFP	COLL	Moderate-High
CROWSNEST	CU.R	FLUV	Low
CUMMINGS	O.DYB	COLL	Moderate-High
FERSTER	GLCU.R	FLUV	Low-Moderate
FESTUBERT	GLCU.R	FLUV	Low-Moderate
FOLLOCK	CU.R	FLUV	Low-Moderate
FOX LAKE	CU.R	FLUV	Low-Moderate
FRAYN MOUNTAIN	CU.R	FLUV	Low-Moderate
GAGNEBIN	O.EB	GLFL	Low-Moderate
GALTON	O.DYB	GLFL	Moderate-High
GOLD CREEK	O.HFP	GLFL	Moderate-High
GOODUM	O.EB	GLFL	Low-Moderate
GYDOSIC	O.HFP	GLFL	Moderate-High
KINGCOME	O.HFP	GLFL	Moderate-High
LANCASTER	BR.GL	GLLC	Low-Moderate
MAIYUK	O.DYB	TILL	Low-Moderate
MANSFIELD	O.DYB	TILL	Low-Moderate
MARCONI	O.HFP	TILL	Moderate
MCCORN	LU.HFP	TILL	Moderate
MCKAY MOUNTAIN	PZ.GL	TILL	Moderate
MCLATCHIE	BR.GL	TILL	Moderate
MCQUAIGLY	PZ.GL	TILL	Moderate
MICHEL	O.EB	GLFL	Low-Moderate
MINITOWN	O.HFP	TILL	Moderate-High
MORRISSETTE	BR.GL	TILL	Moderate
MORRO MOUNTAIN	O.HFP	TILL	Moderate-High
MOUNT MIKE	BR.GL	TILL	Moderate
MURDOCK	O.GL	TILL	Moderate

ODLUMBY	TY.M	UNDO	Low-Moderate
OLSONITE	TY.M	UNDO	Low-Moderate
O'NEILL	TY.M	UNDO	Low-Moderate
RACEHORSE	O.DYB	COLL	Moderate-High
RADIUM	SM.HFP	COLL	Moderate-High
RIDGE RANGE	O.EB	COLL	Low-Moderate
ROBERT CREEK	O.EB	COLL	Low-Moderate
ROTH CREEK	O.HFP	COLL	Low-Moderate
ROUND PRAIRIE	O.DYB	COLL	Low-Moderate
ROURKE	O.HFP	COLL	Low-Moderate
RUALT	O.HFP	COLL	Low-Moderate
UNDIFFERENTIATED BEDROCK	-	RKUD	Low-Moderate
YAHK CREEK	CU.R	COLL	Low-Moderate

"-" = not applicable

Table E-3. Surficial Geology Relative Risk Ratings to Acid Deposition in Alberta in the central portion of the air dispersion/deposition modelling domain

Surficial Geology Feature	Surficial Geology	Relative Risk Rating
Bedrock	sandstone, mudstone, etc.	Low-Moderate
Bedrock	sandstone, mudstone, etc.	Low-Moderate
Colluvial Deposits	gravity deposited unconsolidated sediments and/or bedrock	Low-Moderate
Landslide deposits	gravity deposited unconsolidated sediments and/or bedrock	Low-Moderate
Rockslide deposits	gravity deposited unconsolidated sediments and/or bedrock	Low-Moderate
Talus	gravity deposited unconsolidated sediments and/or bedrock	Low-Moderate
Colluvial Deposits	gravity deposited unconsolidated sediments and/or bedrock	Low-Moderate
Colluvial Deposits	gravity deposited unconsolidated sediments and/or bedrock	Low-Moderate
Fluvial	sand, gravel, and occasionally silt and clay	Moderate-High
Fluvial	sand, gravel, and occasionally silt and clay	Moderate-High
Alluvial fans and aprons	sand, gravel, and occasionally silt and clay	Moderate-High
Fine stream alluvium	sand, gravel, and occasionally silt and clay	Moderate-High
Coarse stream alluvium	sand, gravel, and occasionally silt and clay	Moderate-High
Rock glaciers	permanent snow and ice	N/A
Glaciers	permanent snow and ice	N/A
Valley train	sand and gravel	High
Pitted outwash deposits	sand and gravel	High
Outwash plains	sand and gravel	High
Eskers	sand and gravel	High
Ice-contacted Fluvial	sand and gravel	High
Ice-contacted Fluvial	sand and gravel	High
Meltwater channel deposits	sand and gravel	High
Lacustrine	silt, clay, and occasionally sand and gravel	Low-Moderate
Lacustrine	silt, clay, and occasionally sand and gravel	Low-Moderate
Glaciolacustrine deposits	silt, clay, and occasionally sand and gravel	Low-Moderate
Glaciolacustrine Deposits	silt, clay, and occasionally sand and gravel	Low-Moderate
Ice-contacted Lacustrine	silt, clay, and occasionally sand and gravel	Low-Moderate
Cirque tills	clay	Low
Moraine	clay	Low

Moderately leached till, Cordilleran provenance	clay	Low
Moderately leached till, Continental provenance	clay	Low
Deeply leached till, Cordilleran provenance	clay	Low
Bedrock & Glacial, undivided	clay	Low
Glacial	clay	Low
Slightly leached till, Cordilleran provenance	clay	Low
Organic deposits	peat, etc.	Moderate-High
Stagnant Ice Moraine	clay	Low
Stagnant Ice Moraine	clay	Low
Stagnant Ice Moraine	clay	Low

Appendix F. Predicted Air Concentrations of Trace Elements, Heavy Metals and PAHs

The Pekisko Group
Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies

S50 TSP - Concentration: [ug/m**3]			Air concentration (ug/m3)																						
Average Period	100th Percentile (1st Highest)	Receptor ID	n/a	1.28E-06	3.15E-06	1.85E-04	1.00E-06	1.34E-06	1.10E-05	9.20E-06	2.90E-05	1.37E-05	n/a	1.14E-07	2.10E-06	3.05E-05	1.22E-06	5.00E-07	2.00E-06	4.00E-05	1.61E-04				
Max			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc				
8760-HOUR	1.80E+03	716	#VALUE!	0.0023008	0.0056622	0.332542	0.001798	0.0024087	0.019773	0.016537	0.052128	0.024626	#VALUE!	0.00020492	0.0037748	0.054825	0.002193	0.000899	0.003595	0.071901	0.289402				
Sensitive			#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0				
8760-HOUR	1.27E-01	CARTWRT	#VALUE!	1.631E-07	4.014E-07	2.36E-05	1.27E-07	1.708E-07	1.4E-06	1.17E-06	3.7E-06	1.75E-06	#VALUE!	1.4528E-08	2.6762E-07	3.89E-06	1.555E-07	6.37E-08	2.55E-07	5.1E-06	2.05E-05				
8760-HOUR	1.36E+00	CHIMNEY	#VALUE!	1.744E-06	4.291E-06	0.000252	1.36E-06	1.826E-06	1.5E-05	1.25E-05	3.95E-05	1.87E-05	#VALUE!	1.5531E-07	2.8609E-06	4.16E-05	1.662E-06	6.81E-07	2.72E-06	5.45E-05	0.000219				
8760-HOUR	2.16E-01	BB_RANCH	#VALUE!	2.762E-07	6.796E-07	3.99E-05	2.16E-07	2.891E-07	2.37E-06	1.98E-06	6.26E-06	2.96E-06	#VALUE!	2.4595E-08	4.5307E-07	6.58E-06	2.632E-07	1.08E-07	4.31E-07	8.63E-06	3.47E-05				
8760-HOUR	2.35E+00	RH_CRK	#VALUE!	3.006E-06	7.398E-06	0.000435	2.35E-06	3.147E-06	2.58E-05	2.16E-05	6.81E-05	3.22E-05	#VALUE!	2.6775E-07	4.9322E-06	7.16E-05	2.865E-06	1.17E-06	4.7E-06	9.39E-05	0.000378				
8760-HOUR	1.38E-01	CTRT_CRK	#VALUE!	1.768E-07	4.351E-07	2.56E-05	1.38E-07	1.851E-07	1.52E-06	1.27E-06	4.01E-06	1.89E-06	#VALUE!	1.5746E-08	2.9005E-07	4.21E-06	1.685E-07	6.91E-08	2.76E-07	5.52E-06	2.22E-05				
8760-HOUR	1.20E+00	OLDM_RF	#VALUE!	1.54E-06	3.791E-06	0.000223	1.2E-06	1.613E-06	1.32E-05	1.11E-05	3.49E-05	1.65E-05	#VALUE!	1.372E-07	2.5273E-06	3.67E-05	1.468E-06	6.02E-07	2.41E-06	4.81E-05	0.000194				
8760-HOUR	9.55E+00	LVST_F	#VALUE!	1.223E-05	3.01E-05	0.001768	9.55E-06	1.28E-05	0.000105	8.79E-05	0.000277	0.000131	#VALUE!	1.0892E-06	2.0064E-05	0.000291	1.166E-05	4.78E-06	1.91E-05	0.000382	0.001538				
8760-HOUR	3.14E+00	PLT_MC	#VALUE!	4.016E-06	9.882E-06	0.00058	3.14E-06	4.204E-06	3.45E-05	2.89E-05	9.1E-05	4.3E-05	#VALUE!	3.5765E-07	6.5882E-06	9.57E-05	3.827E-06	1.57E-06	6.27E-06	0.000125	0.000505				
8760-HOUR	2.16E-01	C_GARDN	#VALUE!	2.761E-07	6.794E-07	3.99E-05	2.16E-07	2.89E-07	2.37E-06	1.98E-06	6.25E-06	2.95E-06	#VALUE!	2.4588E-08	4.5293E-07	6.58E-06	2.631E-07	1.08E-07	4.31E-07	8.63E-06	3.47E-05				
8760-HOUR	1.86E-01	S_GARDN	#VALUE!	2.382E-07	5.861E-07	3.44E-05	1.86E-07	2.493E-07	2.05E-06	1.71E-06	5.4E-06	2.55E-06	#VALUE!	2.1211E-08	3.9073E-07	5.67E-06	2.27E-07	9.3E-08	3.72E-07	7.44E-06	3E-05				
8760-HOUR	3.71E-01	RLND_MB	#VALUE!	4.744E-07	1.167E-06	6.86E-05	3.71E-07	4.966E-07	4.08E-06	3.41E-06	1.07E-05	5.08E-06	#VALUE!	4.2248E-08	7.7826E-07	1.13E-05	4.521E-07	1.85E-07	7.41E-07	1.48E-05	5.97E-05				
8760-HOUR	1.03E+00	R_BLAKE	#VALUE!	1.322E-06	3.253E-06	0.000191	1.03E-06	1.384E-06	1.14E-05	9.5E-06	2.99E-05	1.41E-05	#VALUE!	1.1773E-07	2.1688E-06	3.15E-05	1.26E-06	5.16E-07	2.07E-06	4.13E-05	0.000166				
8760-HOUR	9.83E-01	B_RANSOM	#VALUE!	1.259E-06	3.097E-06	0.000182	9.83E-07	1.318E-06	1.08E-05	9.05E-06	2.85E-05	1.35E-05	#VALUE!	1.121E-07	2.065E-06	3E-05	1.2E-06	4.92E-07	1.97E-06	3.93E-05	0.000158				
8760-HOUR	8.42E-01	RCKP_PL	#VALUE!	1.078E-06	2.652E-06	0.000156	8.42E-07	1.128E-06	9.26E-06	7.75E-06	2.44E-05	1.15E-05	#VALUE!	9.5994E-08	1.7683E-06	2.57E-05	1.027E-06	4.21E-07	1.68E-06	3.37E-05	0.000136				
8760-HOUR	1.27E+00	S_HARVEY	#VALUE!	1.622E-06	3.992E-06	0.000234	1.27E-06	1.698E-06	1.39E-05	1.17E-05	3.68E-05	1.74E-05	#VALUE!	1.4448E-07	2.6615E-06	3.87E-05	1.546E-06	6.34E-07	2.53E-06	5.07E-05	0.000204				
8760-HOUR	1.13E+00	R_DAVIS	#VALUE!	1.451E-06	3.571E-06	0.00021	1.13E-06	1.519E-06	1.25E-05	1.04E-05	3.29E-05	1.55E-05	#VALUE!	1.2923E-07	2.3806E-06	3.46E-05	1.383E-06	5.67E-07	2.27E-06	4.53E-05	0.000183				
8760-HOUR	1.19E+00	RESIDEN	#VALUE!	1.525E-06	3.753E-06	0.00022	1.19E-06	1.596E-06	1.31E-05	1.1E-05	3.45E-05	1.63E-05	#VALUE!	1.3581E-07	2.5018E-06	3.63E-05	1.453E-06	5.96E-07	2.38E-06	4.77E-05	0.000192				
8760-HOUR	1.18E+00	COCHLAN	#VALUE!	1.515E-06	3.729E-06	0.000219	1.18E-06	1.586E-06	1.3E-05	1.09E-05	3.43E-05	1.62E-05	#VALUE!	1.3496E-07	2.4861E-06	3.61E-05	1.444E-06	5.92E-07	2.37E-06	4.74E-05	0.000191				
8760-HOUR	7.26E+00	N_RCKP	#VALUE!	9.295E-06	2.287E-05	0.001343	7.26E-06	9.73E-06	7.99E-05	6.68E-05	0.000211	9.95E-05	#VALUE!	8.2781E-07	1.5249E-05	0.000221	8.859E-06	3.63E-06	1.45E-05	0.00029	0.001169				
8760-HOUR	7.18E-01	NW_RCKP	#VALUE!	9.193E-07	2.262E-06	0.000133	7.18E-07	9.624E-07	7.9E-06	6.61E-06	2.08E-05	9.84E-06	#VALUE!	8.1878E-08	1.5083E-06	2.19E-05	8.762E-07	3.59E-07	1.44E-06	2.87E-05	0.000116				
8760-HOUR	2.98E+00	S_RCKP	#VALUE!	3.811E-06	9.379E-06	0.000551	2.98E-06	3.99E-06	3.28E-05	2.74E-05	8.63E-05	4.08E-05	#VALUE!	3.3944E-07	6.2528E-06	9.08E-05	3.633E-06	1.49E-06	5.96E-06	0.000119	0.000479				
8760-HOUR	4.10E+00	E_RCKP	#VALUE!	5.253E-06	1.293E-05	0.000759	4.1E-06	5.5E-06	4.51E-05	3.78E-05	0.000119	5.62E-05	#VALUE!	4.6788E-07	8.6189E-06	0.000125	5.007E-06	2.05E-06	8.21E-06	0.000164	0.000661				
8760-HOUR	3.50E+00	W_RCKP	#VALUE!	4.479E-06	1.102E-05	0.000647	3.5E-06	4.689E-06	3.85E-05	3.22E-05	0.000101	4.79E-05	#VALUE!	3.9891E-07	7.3484E-06	0.000107	4.269E-06	1.75E-06	7E-06	0.00014	0.000563				
8760-HOUR	1.07E+00	WLDRN_N	#VALUE!	1.372E-06	3.377E-06	0.000198	1.07E-06	1.437E-06	1.18E-05	9.86E-06	3.11E-05	1.47E-05	#VALUE!	1.2222E-07	2.2514E-06	3.27E-05	1.308E-06	5.36E-07	2.14E-06	4.29E-05	0.000173				
8760-HOUR	1.56E+00	WLDRN_S	#VALUE!	1.992E-06	4.902E-06	0.000288	1.56E-06	2.085E-06	1.71E-05	1.43E-05	4.51E-05	2.13E-05	#VALUE!	1.7742E-07	3.2683E-06	4.75E-05	1.899E-06	7.78E-07	3.11E-06	6.23E-05	0.000251				
8760-HOUR	1.40E+00	BOB_BNB	#VALUE!	1.792E-06	4.411E-06	0.000259	1.4E-06	1.876E-06	1.54E-05	1.29E-05	4.06E-05	1.92E-05	#VALUE!	1.5962E-07	2.9404E-06	4.27E-05	1.708E-06	7E-07	2.8E-06	5.6E-05	0.000225				
8760-HOUR	1.60E-01	BLADE_R	#VALUE!	2.049E-07	5.043E-07	2.96E-05	1.6E-07	2.145E-07	1.76E-06	1.47E-06	4.64E-06	2.19E-06	#VALUE!	1.8252E-08	3.3622E-07	4.88E-06	1.953E-07	8.01E-08	3.2E-07	6.4E-06	2.58E-05				
8760-HOUR	2.00E+00	LVG_GAP	#VALUE!	2.559E-06	6.298E-06	0.00037	2E-06	2.679E-06	2.2E-05	1.84E-05	5.8E-05	2.74E-05	#VALUE!	2.2794E-07	4.1989E-06	6.1E-05	2.439E-06	1E-06	4E-06	8E-05	0.000322				
8760-HOUR	3.44E+00	OM_RVR	#VALUE!	4.406E-06	1.084E-05	0.000637	3.44E-06	4.613E-06	3.79E-05	3.17E-05	9.98E-05	4.72E-05	#VALUE!	3.9242E-07	7.2287E-06	0.000105	4.2E-06	1.72E-06	6.88E-06	0.000138	0.000554				
8760-HOUR	3.39E+00	ATRM_EN	#VALUE!	4.343E-06	1.069E-05	0.000628	3.39E-06	4.546E-06	3.73E-05	3.12E-05	9.84E-05	4.65E-05	#VALUE!	3.8677E-07	7.1248E-06	0.000103	4.139E-06	1.7E-06	6.79E-06	0.000136	0.000546				
8760-HOUR	2.22E+00	CBN_RDG	#VALUE!	2.844E-06	6.999E-06	0.000411	2.22E-06	2.977E-06	2.44E-05	2.04E-05	6.44E-05	3.04E-05	#VALUE!	2.5331E-07	4.6662E-06	6.78E-05	2.711E-06	1.11E-06	4.44E-06	8.89E-05	0.000358				
8760-HOUR	1.92E+00	CR_HM_EN	#VALUE!	2.46E-06	6.054E-06	0.000356	1.92E-06	2.575E-06	2.11E-05	1.77E-05	5.57E-05	2.63E-05	#VALUE!	2.191E-07	4.0361E-06	5.86E-05	2.345E-06	9.61E-07	3.84E-06	7.69E-05	0.000309				
8760-HOUR	1.74E+00	HNVMNCRK	#VALUE!	2.227E-06	5.481E-06	0.000322	1.74E-06	2.331E-06	1.91E-05	1.6E-05	5.05E-05	2.38E-05	#VALUE!	1.9835E-07	3.6538E-06	5.31E-05	2.123E-06	8.7E-07	3.48E-06	6.96E-05	0.00028				
8760-HOUR	6.05E+00	BLADE_C	#VALUE!	7.742E-06	1.905E-05	0.001119	6.05E-06	8.105E-06	6.65E-05	5.56E-05	0.000175	8.29E-05	#VALUE!	6.895E-07	1.2701E-05	0.000184	7.379E-06	3.02E-06	1.21E-05	0.000242	0.000974				
8760-HOUR	5.98E+00	MCLY_CRK	#VALUE!	7.657E-06	1.884E-05	0.001107	5.98E-06	8.016E-06	6.58E-05	5.5E-05	0.000173	8.2E-05	#												

The Pekisko Group
Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies

SO TSP - Concentration: [ug/m**3]			ug/m3																		
Average Period	100th Percentile (1st Highest)	Receptor ID	n/a	1.28E-06	3.15E-06	1.85E-04	1.00E-06	1.34E-06	1.10E-05	9.20E-06	2.90E-05	1.37E-05	n/a	1.14E-07	2.10E-06	3.05E-05	1.22E-06	5.00E-07	2.00E-06	4.00E-05	1.61E-04
MPOI			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
8760-HOUR	3.60E+03	716	#VALUE!	4.60E-03	0.0113244	0.665084	0.003595	0.0048174	0.039546	0.033074	0.104256	0.049252	#VALUE!	0.0004984	0.00754961	0.109649	0.004386	0.001798	0.00719	0.143802	0.578803
Sensitive			#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0
8760-HOUR	2.55E-01	CARTWRT	#VALUE!	3.262E-07	8.029E-07	4.72E-05	2.55E-07	3.415E-07	2.8E-06	2.34E-06	7.39E-06	3.49E-06	#VALUE!	2.9056E-08	5.3525E-07	7.77E-06	3.11E-07	1.27E-07	5.1E-07	1.02E-05	4.1E-05
8760-HOUR	2.72E+00	CHIMNEY	#VALUE!	3.488E-06	8.583E-06	0.000504	2.72E-06	3.651E-06	3E-05	2.51E-05	7.9E-05	3.73E-05	#VALUE!	3.1062E-07	5.7219E-06	8.31E-05	3.324E-06	1.36E-06	5.45E-06	0.000109	0.000439
8760-HOUR	4.31E-01	BB_RANCH	#VALUE!	5.523E-07	1.359E-06	7.98E-05	4.31E-07	5.782E-07	4.75E-06	3.97E-06	1.25E-05	5.91E-06	#VALUE!	4.919E-08	9.0614E-07	1.32E-05	5.264E-07	2.16E-07	8.63E-07	1.73E-05	6.95E-05
8760-HOUR	4.70E+00	RH_CRK	#VALUE!	6.013E-06	1.48E-05	0.000869	4.7E-06	6.294E-06	5.17E-05	4.32E-05	0.000136	6.44E-05	#VALUE!	5.3549E-07	9.8643E-06	0.000143	5.731E-06	2.35E-06	9.39E-06	0.000188	0.000756
8760-HOUR	2.76E-01	CTRT_CRK	#VALUE!	3.536E-07	8.702E-07	5.11E-05	2.76E-07	3.702E-07	3.04E-06	2.54E-06	8.01E-06	3.78E-06	#VALUE!	3.1491E-08	5.801E-07	8.43E-06	3.37E-07	1.38E-07	5.52E-07	1.1E-05	4.45E-05
8760-HOUR	2.41E+00	OLDM_RF	#VALUE!	3.081E-06	7.582E-06	0.000445	2.41E-06	3.225E-06	2.65E-05	2.21E-05	6.98E-05	3.3E-05	#VALUE!	2.7439E-07	5.0546E-06	7.34E-05	2.936E-06	1.2E-06	4.81E-06	9.63E-05	0.000388
8760-HOUR	1.91E+01	LVST_F	#VALUE!	2.446E-05	6.019E-05	0.003535	1.91E-05	2.561E-05	0.00021	0.000176	0.000554	0.000262	#VALUE!	2.1784E-06	4.0128E-05	0.000583	2.331E-05	9.55E-06	3.82E-05	0.000764	0.003076
8760-HOUR	6.27E+00	PLT_MC	#VALUE!	8.031E-06	1.976E-05	0.001161	6.27E-06	8.408E-06	6.9E-05	5.77E-05	0.000182	8.6E-05	#VALUE!	7.1529E-07	1.3176E-05	0.000191	7.655E-06	3.14E-06	1.25E-05	0.000251	0.00101
8760-HOUR	4.31E-01	C_GARDN	#VALUE!	5.521E-07	1.359E-06	7.98E-05	4.31E-07	5.78E-07	4.75E-06	3.97E-06	1.25E-05	5.91E-06	#VALUE!	4.9176E-08	9.0587E-07	1.32E-05	5.263E-07	1.26E-07	8.63E-07	1.73E-05	6.94E-05
8760-HOUR	3.72E-01	S_GARDN	#VALUE!	4.763E-07	1.172E-06	6.88E-05	3.72E-07	4.986E-07	4.09E-06	3.42E-06	1.08E-05	5.1E-06	#VALUE!	4.2422E-08	7.8145E-07	1.13E-05	4.54E-07	1.86E-07	7.44E-07	1.49E-05	5.99E-05
8760-HOUR	7.41E-01	RLND_MB	#VALUE!	9.487E-07	2.335E-06	0.000137	7.41E-07	9.932E-07	8.15E-06	6.82E-06	2.15E-05	1.02E-05	#VALUE!	8.4497E-08	1.5565E-06	2.26E-05	9.043E-07	3.71E-07	1.48E-06	2.96E-05	0.000119
8760-HOUR	2.07E+00	R_BLAKE	#VALUE!	2.644E-06	6.506E-06	0.000382	2.07E-06	2.768E-06	2.27E-05	1.9E-05	5.99E-05	2.83E-05	#VALUE!	2.3547E-07	4.3376E-06	6.3E-05	2.52E-06	1.03E-06	4.13E-06	8.26E-05	0.000333
8760-HOUR	1.97E+00	B_RANSOM	#VALUE!	2.517E-06	6.195E-06	0.000364	1.97E-06	2.635E-06	2.16E-05	1.81E-05	5.7E-05	2.69E-05	#VALUE!	2.242E-07	4.13E-06	6E-05	2.399E-06	9.83E-07	3.93E-06	7.87E-05	0.000317
8760-HOUR	1.68E+00	RCKP_PLG	#VALUE!	2.156E-06	5.305E-06	0.000312	1.68E-06	2.257E-06	1.85E-05	1.55E-05	4.88E-05	2.31E-05	#VALUE!	1.9199E-07	3.5366E-06	5.14E-05	2.055E-06	8.42E-07	3.37E-06	6.74E-05	0.000271
8760-HOUR	2.53E+00	S_HARVEY	#VALUE!	3.245E-06	7.985E-06	0.000469	2.53E-06	3.397E-06	2.79E-05	2.33E-05	7.35E-05	3.47E-05	#VALUE!	2.8897E-07	5.3231E-06	7.73E-05	3.092E-06	1.27E-06	5.07E-06	0.000101	0.000408
8760-HOUR	2.27E+00	R_DAVIS	#VALUE!	2.902E-06	7.142E-06	0.000419	2.27E-06	3.038E-06	2.49E-05	2.09E-05	6.57E-05	3.11E-05	#VALUE!	2.5846E-07	4.7611E-06	6.91E-05	2.766E-06	1.13E-06	4.53E-06	9.07E-05	0.000365
8760-HOUR	2.38E+00	RESIDEN	#VALUE!	3.05E-06	7.505E-06	0.000441	2.38E-06	3.193E-06	2.62E-05	2.19E-05	6.91E-05	3.26E-05	#VALUE!	2.7162E-07	5.0036E-06	7.27E-05	2.907E-06	1.19E-06	4.77E-06	9.53E-05	0.000384
8760-HOUR	2.37E+00	COCHLAN	#VALUE!	3.031E-06	7.458E-06	0.000438	2.37E-06	3.173E-06	2.6E-05	2.18E-05	6.87E-05	3.24E-05	#VALUE!	2.6992E-07	4.9722E-06	7.22E-05	2.889E-06	1.18E-06	4.74E-06	9.47E-05	0.000381
8760-HOUR	1.45E+01	N_RCKP	#VALUE!	1.859E-05	4.575E-05	0.002687	1.45E-05	1.946E-05	0.00016	0.000134	0.000421	0.000199	#VALUE!	1.6556E-06	3.0498E-05	0.000443	1.772E-05	7.26E-06	2.9E-05	0.000581	0.002338
8760-HOUR	1.44E+00	NW_RCKP	#VALUE!	1.839E-06	4.525E-06	0.000266	1.44E-06	1.925E-06	1.58E-05	1.32E-05	4.17E-05	1.97E-05	#VALUE!	1.6376E-07	3.0165E-06	4.38E-05	1.752E-06	7.18E-07	2.87E-06	5.75E-05	0.000231
8760-HOUR	5.96E+00	S_RCKP	#VALUE!	7.622E-06	1.876E-05	0.001102	5.96E-06	7.98E-06	6.55E-05	5.48E-05	0.000173	8.16E-05	#VALUE!	6.7887E-07	1.2506E-05	0.000182	7.265E-06	2.98E-06	1.19E-05	0.000238	0.000959
8760-HOUR	8.21E+00	E_RCKP	#VALUE!	1.051E-05	2.586E-05	0.001519	8.21E-06	1.1E-05	9.03E-05	7.55E-05	0.000238	0.000112	#VALUE!	9.3577E-07	1.7238E-05	0.00025	1.001E-05	4.1E-06	1.64E-05	0.000328	0.001322
8760-HOUR	7.00E+00	W_RCKP	#VALUE!	8.958E-06	2.205E-05	0.001295	7E-06	9.378E-06	7.7E-05	6.44E-05	0.000203	9.59E-05	#VALUE!	7.9783E-07	1.4697E-05	0.000213	8.538E-06	3.5E-06	1.4E-05	0.00028	0.001127
8760-HOUR	2.14E+00	WLDRN_N	#VALUE!	2.745E-06	6.754E-06	0.000397	2.14E-06	2.873E-06	2.36E-05	1.97E-05	6.22E-05	2.94E-05	#VALUE!	2.4444E-07	4.5028E-06	6.54E-05	2.616E-06	1.07E-06	4.29E-06	8.58E-05	0.000345
8760-HOUR	3.11E+00	WLDRN_S	#VALUE!	3.984E-06	9.805E-06	0.000576	3.11E-06	4.171E-06	3.42E-05	2.86E-05	9.03E-05	4.26E-05	#VALUE!	3.5484E-07	6.5366E-06	9.49E-05	3.797E-06	1.56E-06	6.23E-06	0.000125	0.000501
8760-HOUR	2.80E+00	BOB_BNB	#VALUE!	3.585E-06	8.821E-06	0.000518	2.8E-06	3.753E-06	3.08E-05	2.58E-05	8.12E-05	3.84E-05	#VALUE!	3.1925E-07	5.8808E-06	8.54E-05	3.416E-06	1.4E-06	5.6E-06	0.000112	0.000451
8760-HOUR	3.20E-01	BLADE_R	#VALUE!	4.099E-07	1.009E-06	5.92E-05	3.2E-07	4.291E-07	3.52E-06	2.95E-06	9.29E-06	4.39E-06	#VALUE!	3.6503E-08	6.7243E-07	9.77E-06	3.907E-07	1.6E-07	6.4E-07	1.28E-05	5.16E-05
8760-HOUR	4.00E+00	LVG_GAP	#VALUE!	5.119E-06	1.26E-05	0.00074	4E-06	5.359E-06	4.4E-05	3.68E-05	0.000116	5.48E-05	#VALUE!	4.5588E-07	8.3978E-06	0.000122	4.879E-06	2E-06	8E-06	0.00016	0.000644
8760-HOUR	6.88E+00	OM_RVR	#VALUE!	8.812E-06	2.169E-05	0.001274	6.88E-06	9.225E-06	7.57E-05	6.33E-05	0.0002	9.43E-05	#VALUE!	7.8483E-07	1.4457E-05	0.00021	8.399E-06	3.44E-06	1.38E-05	0.000275	0.001108
8760-HOUR	6.79E+00	ATRM_EN	#VALUE!	8.685E-06	2.137E-05	0.001255	6.79E-06	9.093E-06	7.46E-05	6.24E-05	0.000197	9.3E-05	#VALUE!	7.7355E-07	1.425E-05	0.000207	8.278E-06	3.39E-06	1.36E-05	0.000271	0.001092
8760-HOUR	4.44E+00	CBN_RDG	#VALUE!	5.688E-06	1.4E-05	0.000822	4.44E-06	5.955E-06	4.89E-05	4.09E-05	0.000129	6.09E-05	#VALUE!	5.0662E-07	9.3324E-06	0.000136	5.422E-06	2.22E-06	8.89E-06	0.000178	0.000715
8760-HOUR	3.84E+00	CR_HM_EN	#VALUE!	4.92E-06	1.211E-05	0.000711	3.84E-06	5.151E-06	4.23E-05	3.54E-05	0.000111	5.27E-05	#VALUE!	4.382E-07	8.0722E-06	0.000117	4.69E-06	1.92E-06	7.69E-06	0.000154	0.000619
8760-HOUR	3.48E+00	HNMYNCRK	#VALUE!	4.454E-06	1.096E-05	0.000644	3.48E-06	4.663E-06	3.83E-05	3.2E-05	0.000101	4.77E-05	#VALUE!	3.967E-07	7.3077E-06	0.000106	4.245E-06	1.74E-06	6.96E-06	0.000139	0.00056
8760-HOUR	1.21E+01	BLADE_C	#VALUE!	1.548E-05	3.81E-05	0.002238	1.21E-05	1.621E-05	0.000133	0.000111	0.000351	0.000166	#VALUE!	1.379E-06	2.5403E-05	0.000369	1.476E-05	6.05E-06	2.42E-05	0.000484	0.001948
8760-HOUR	1.20E+01	M																			

The Pekisko Group
Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies

S50 PM2.5 - Concentration: [ug/m**3]			9.80E-05	1.93E-04	2.60E-05	1.30E-05	5.00E-06	2.30E-05	1.20E-05	5.00E-06	3.20E-05	7.00E-06	8.40E-05	2.67E-04	9.00E-06	2.71E-03	8.52E-04	7.70E-05
Average Period	100th Percentile (1st Highest)	Receptor ID	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indo(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
Max																		
8760-HOUR	47.44	716	4.65E-03	9.16E-03	1.23E-03	6.17E-04	2.37E-04	1.09E-03	5.69E-04	2.37E-04	1.52E-03	3.32E-04	3.99E-03	1.27E-02	4.27E-04	1.29E-01	4.04E-02	3.65E-03
Sensitive			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8760-HOUR	3.65E-02	CARTWRT	3.58E-06	7.04E-06	9.49E-07	4.75E-07	1.83E-07	8.40E-07	4.38E-07	1.83E-07	1.17E-06	2.56E-07	3.07E-06	9.75E-06	3.29E-07	9.89E-05	3.11E-05	2.81E-06
8760-HOUR	1.66E-01	CHIMNEY	1.63E-05	3.21E-05	4.32E-06	2.16E-06	8.31E-07	3.82E-06	1.99E-06	8.31E-07	5.32E-06	1.16E-06	1.40E-05	4.44E-05	1.50E-06	4.50E-04	1.42E-04	1.28E-05
8760-HOUR	4.80E-02	BB_RANCH	4.71E-06	9.27E-06	1.25E-06	6.24E-07	2.40E-07	1.10E-06	5.76E-07	2.40E-07	1.54E-06	3.36E-07	4.03E-06	1.28E-05	4.32E-07	1.30E-04	4.09E-05	3.70E-06
8760-HOUR	2.91E-01	RH_CRK	2.85E-05	5.62E-05	7.57E-06	3.78E-06	1.46E-06	6.69E-06	3.49E-06	1.46E-06	9.31E-06	2.04E-06	2.44E-05	7.77E-05	2.62E-06	7.89E-04	2.48E-04	2.24E-05
8760-HOUR	4.52E-02	CTR_T_CRK	4.43E-06	8.73E-06	1.18E-06	5.88E-07	2.26E-07	1.04E-06	5.43E-07	2.26E-07	1.45E-06	3.17E-07	3.80E-06	1.21E-05	4.07E-07	1.23E-04	3.85E-05	3.48E-06
8760-HOUR	1.82E-01	OLDM_RF	1.78E-05	3.51E-05	4.73E-06	2.36E-06	9.09E-07	4.18E-06	2.18E-06	9.09E-07	5.82E-06	1.27E-06	1.53E-05	4.85E-05	1.64E-06	4.93E-04	1.55E-04	1.40E-05
8760-HOUR	7.30E-01	LVST_F	7.16E-05	1.41E-04	1.90E-05	9.49E-06	3.65E-06	1.68E-05	8.76E-06	3.65E-06	2.34E-05	5.11E-06	6.14E-05	1.95E-04	6.57E-06	1.98E-03	6.22E-04	5.62E-05
8760-HOUR	3.38E-01	PLT_MC	3.31E-05	6.52E-05	7.97E-06	4.39E-06	1.69E-06	7.77E-06	4.06E-06	1.69E-06	1.08E-05	2.37E-06	2.84E-05	9.03E-05	4.04E-06	9.16E-04	2.88E-04	2.60E-05
8760-HOUR	4.80E-02	C_GARDN	4.70E-06	9.26E-06	1.25E-06	6.24E-07	2.40E-07	1.10E-06	5.76E-07	2.40E-07	1.54E-06	3.36E-07	4.03E-06	1.28E-05	4.32E-07	1.30E-04	4.09E-05	3.70E-06
8760-HOUR	4.44E-02	S_GARDN	4.35E-06	8.57E-06	1.15E-06	5.77E-07	2.22E-07	1.02E-06	5.33E-07	2.22E-07	1.42E-06	3.11E-07	3.73E-06	1.19E-05	4.00E-07	1.20E-04	3.78E-05	3.42E-06
8760-HOUR	6.23E-02	R_LND_MB	6.11E-06	1.20E-05	1.62E-06	8.10E-07	3.12E-07	1.43E-06	7.48E-07	3.12E-07	2.00E-06	4.36E-07	5.24E-06	1.66E-05	5.61E-07	1.69E-04	5.31E-05	4.80E-06
8760-HOUR	1.25E-01	R_BLAKE	1.23E-05	2.42E-05	3.26E-06	1.63E-06	6.27E-07	2.89E-06	1.51E-06	6.27E-07	4.02E-06	8.78E-07	1.05E-05	3.35E-05	1.13E-06	3.40E-04	1.07E-04	9.66E-06
8760-HOUR	1.21E-01	B_RANSOM	1.19E-05	2.34E-05	3.15E-06	1.58E-06	6.07E-07	2.79E-06	1.46E-06	6.07E-07	3.88E-06	8.49E-07	1.02E-05	3.24E-05	1.09E-06	3.29E-04	1.03E-04	9.34E-06
8760-HOUR	1.09E-01	RCKP_PLC	1.07E-05	2.10E-05	2.83E-06	1.41E-06	5.44E-07	2.50E-06	1.30E-06	5.44E-07	3.48E-06	7.61E-07	9.13E-06	2.90E-05	9.79E-07	2.95E-04	9.26E-05	8.37E-06
8760-HOUR	1.57E-01	S_HARVEY	1.54E-05	3.02E-05	4.07E-06	2.04E-06	7.83E-07	3.60E-06	1.88E-06	7.83E-07	5.01E-06	1.10E-06	1.32E-05	4.18E-05	1.41E-06	4.25E-04	1.33E-04	1.21E-05
8760-HOUR	1.41E-01	R_DAVIS	1.38E-05	2.72E-05	3.66E-06	1.83E-06	7.04E-07	3.24E-06	1.69E-06	7.04E-07	4.51E-06	9.86E-07	1.18E-05	3.76E-05	1.27E-06	3.82E-04	1.20E-04	1.08E-05
8760-HOUR	1.48E-01	RESIDEN	1.45E-05	2.86E-05	3.85E-06	1.93E-06	7.41E-07	3.41E-06	1.78E-06	7.41E-07	4.74E-06	1.04E-06	1.25E-05	3.96E-05	1.33E-06	4.02E-04	1.26E-04	1.14E-05
8760-HOUR	1.47E-01	COCHLAN	1.44E-05	2.84E-05	3.83E-06	1.92E-06	7.37E-07	3.39E-06	1.77E-06	7.37E-07	4.71E-06	1.03E-06	1.24E-05	3.93E-05	1.33E-06	3.99E-04	1.26E-04	1.13E-05
8760-HOUR	5.86E-01	N_RCKP	5.74E-05	1.13E-04	1.52E-05	7.62E-06	2.93E-06	1.35E-05	7.03E-06	2.93E-06	1.88E-05	4.10E-06	4.92E-05	1.56E-04	5.27E-06	1.59E-03	4.99E-04	4.51E-05
8760-HOUR	1.37E-01	NW_RCKP	1.35E-05	2.65E-05	3.57E-06	1.79E-06	6.87E-07	3.16E-06	1.65E-06	6.87E-07	4.39E-06	9.61E-07	1.15E-05	3.67E-05	1.24E-06	3.72E-04	1.17E-04	1.06E-05
8760-HOUR	3.22E-01	S_RCKP	3.16E-05	6.22E-05	8.38E-06	4.19E-06	1.61E-06	7.41E-06	3.87E-06	1.61E-06	1.03E-05	2.26E-06	2.71E-05	8.61E-05	2.90E-06	8.74E-04	2.75E-04	2.48E-05
8760-HOUR	4.03E-01	E_RCKP	3.94E-05	7.77E-05	1.05E-05	5.23E-06	2.01E-06	9.26E-06	4.83E-06	2.01E-06	1.29E-05	2.82E-06	3.38E-05	1.07E-04	3.62E-06	1.09E-03	3.43E-04	3.10E-05
8760-HOUR	3.54E-01	W_RCKP	3.47E-05	6.82E-05	9.19E-06	4.60E-06	1.77E-06	8.13E-06	4.24E-06	1.77E-06	1.13E-05	2.48E-06	2.97E-05	9.44E-05	3.18E-06	9.58E-04	3.01E-04	2.72E-05
8760-HOUR	1.46E-01	WLDNR_N	1.43E-05	2.82E-05	3.81E-06	1.90E-06	7.32E-07	3.37E-06	1.76E-06	7.32E-07	4.68E-06	1.02E-06	1.23E-05	3.91E-05	1.32E-06	3.97E-04	1.25E-04	1.13E-05
8760-HOUR	1.92E-01	WLDNR_S	1.89E-05	3.71E-05	5.00E-06	2.50E-06	9.62E-07	4.43E-06	2.31E-06	9.62E-07	6.16E-06	1.35E-06	1.62E-05	5.14E-05	1.73E-06	5.21E-04	1.64E-04	1.48E-05
8760-HOUR	1.89E-01	BOB_BNB	1.86E-05	3.66E-05	4.92E-06	2.46E-06	9.47E-07	4.36E-06	2.27E-06	9.47E-07	6.06E-06	1.33E-06	1.59E-05	5.06E-05	1.70E-06	5.13E-04	1.61E-04	1.46E-05
8760-HOUR	3.78E-02	BLADE_R	3.70E-06	7.29E-06	9.82E-07	4.91E-07	1.89E-07	8.69E-07	4.53E-07	1.89E-07	1.21E-06	2.64E-07	3.17E-06	1.01E-05	3.40E-07	1.02E-04	3.22E-05	2.91E-06
8760-HOUR	2.59E-01	LVG_GAP	2.54E-05	5.00E-05	6.73E-06	3.37E-06	1.30E-06	5.96E-06	3.11E-06	1.30E-06	8.29E-06	1.81E-06	2.18E-05	6.92E-05	2.33E-06	7.02E-04	2.21E-04	1.99E-05
8760-HOUR	3.53E-01	OM_RVR	3.46E-05	6.81E-05	9.17E-06	4.59E-06	1.76E-06	8.11E-06	4.23E-06	1.76E-06	1.13E-05	2.47E-06	2.96E-05	9.42E-05	3.18E-06	9.56E-04	3.01E-04	2.72E-05
8760-HOUR	3.60E-01	ATRM_EN	3.52E-05	6.94E-05	9.35E-06	4.68E-06	1.80E-06	8.27E-06	4.32E-06	1.80E-06	1.15E-05	2.52E-06	3.02E-05	9.60E-05	3.24E-06	9.75E-04	3.06E-04	2.77E-05
8760-HOUR	2.80E-01	CBN_RDG	2.75E-05	5.41E-05	7.28E-06	3.64E-06	1.40E-06	6.44E-06	3.36E-06	1.40E-06	8.96E-06	1.96E-06	2.35E-05	7.48E-05	2.52E-06	7.59E-04	2.39E-04	2.16E-05
8760-HOUR	2.23E-01	CR_HM_EN	2.19E-05	4.31E-05	5.81E-06	2.91E-06	1.12E-06	5.14E-06	2.68E-06	1.12E-06	7.15E-06	1.56E-06	1.88E-05	5.97E-05	2.01E-06	6.06E-04	1.90E-04	1.72E-05
8760-HOUR	2.16E-01	HNYMCRK	2.11E-05	4.16E-05	5.61E-06	2.80E-06	1.08E-06	4.96E-06	2.59E-06	1.08E-06	6.90E-06	1.51E-06	1.81E-05	5.76E-05	1.94E-06	5.85E-04	1.84E-04	1.66E-05
8760-HOUR	5.34E-01	BLADE_C	5.23E-05	1.03E-04	1.39E-05	6.94E-06	2.67E-06	1.23E-05	6.41E-06	2.67E-06	1.71E-05	3.74E-06	4.49E-05	1.43E-04	4.81E-06	1.45E-03	4.55E-04	4.11E-05
8760-HOUR	5.28E-01	MCCLY_CRK	5.18E-05	1.02E-04	1.37E-05	6.87E-06	2.64E-06	1.22E-05	6.34E-06	2.64E-06	1.69E-05	3.70E-06	4.44E-05	1.41E-04	4.76E-06	1.43E-03	4.50E-04	4.07E-05
8760-HOUR	2.23E-01	DENNIS	2.19E-05	4.31E-05	5.81E-06	2.91E-06	1.12E-06	5.14E-06	2.68E-06	1.12E-06	7.15E-06	1.56E-06	1.88E-05	5.97E-05	2.01E-06	6.06E-04	1.90E-04	1.72E-05
8760-HOUR	5.39E-01	PLT_NE	5.28E-05	1.04E-04	1.40E-05	7.01E-06	2.70E-06	1.24E-05	6.47E-06	2.70E-06	1.73E-05	3.77E-06	4.53E-05	1.44E-04	4.85E-06	1.46E-03	4.59E-04	4.15E-05
8760-HOUR	1.25E-01	PLT_NW	1.22E-05	2.41E-05	3.25E-06	1.62E-06	6.25E-07	2.87E-06	1.50E-06	6.25E-07	4.00E-06	8.75E-07	1.05E-05	3.34E-05	1.12E-06	3.39E-04	1.06E-04	9.62E-06
8760-HOUR	1.57E+00	PLT_SW	1.54E-04	3.03E-04	4.08E-05	2.04E-05	7.84E-06	3.61E-05	1.88E-05	7.84E-06	5.02E-05	1.10E-05	1.32E-04	4.19E-04	1.41E-05	4.25E-03	1.34E-03	1.21E-04
8760-HOUR	5.76E-01	PLT_SE	5.65E-05	1.11E-04	1.50E-05	7.49E-06	2.88E-06	1.32E-05	6.91E-06	2.88E-06	1.84E-05	4.03E-06	4.84E-05	1.54E-04	5.18E-06	1.56E-03	4.91E-04	4.44E-05
8760-HOUR	1.76E-01	RCKP_E	1.73E-05	3.40E-05	4.58E-06	2.29E-06	8.81E-07	4.05E-06	2.11E-06	8.81E-07	5.64E-06	1.23E-06	1.48E-05	4.70E-05	1.58E-06	4.77E-04	1.50E-04	1.36E-05
8760-HOUR	4.20E-02	RCKP_NE	4.12E-06	8.11E-06	1.09E-06	5.47E-07	2.10E-07	9.67E-07	5.05E-07	2.10E-07	1.35E-06	2.94E-07	3.53E-06	1.12E-05	3.78E-07	1.14E-04	3.58E-05	3.24E-06
8760-HOUR	2.49E-02	RCKP_NW	2.44E-06	4.80E-06	6.46E-07	3.23E-07	1.24E-07	5.72E-07	2.98E-07	1.24E-07	7.96E-07	1.74E-07	2.09E-06	6.64E-06	2.24E-07	6.74E-05	2.12E-05	1.91E-06
8760-HOUR	1.08E+00	RCKP_SW	1.06E-04	2.08E-04	2.81E-05	1.40E-05	5.40E-06	2.48E-05	1.30E-05	5.40E-06	3.45E-05	7.56E-06	9.07E-05	2.88E-04	9.72E-06	2.93E-03	9.20E-04	8.31E-05
8760-HOUR	2.00E-01	RCKP_SE	1.96E-05	3.86E-05	5.20E-06	2.60E-06	1.00E-06	4.60E-06	2.40E-06	1.00E-06	6.40E-06	1.40E-06	1.68E-05	5.34E-05	1.80E-06	5.42E-04	1.70E-04	1.54E-05
8760-HOUR	4.13E-02	PLATEAU	4.05E-06	7.97E-06	1.07E-													

The Pekisko Group
Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies

S0 PM2.5 - Concentration: [ug/m ³]			9.80E-05	1.93E-04	2.60E-05	1.30E-05	5.00E-06	2.30E-05	1.20E-05	5.00E-06	3.20E-05	7.00E-06	8.40E-05	2.67E-04	9.00E-06	2.71E-03	8.52E-04	7.70E-05
Average Period	100th Percentile (1st Highest)	Receptor ID	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indo(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
Max																		
8760-HOUR	47.44	716	9.30E-03	1.83E-02	2.47E-03	1.23E-03	4.74E-04	2.18E-03	1.14E-03	4.74E-04	3.04E-03	6.64E-04	7.97E-03	2.53E-02	8.54E-04	2.57E-01	8.08E-02	7.31E-03
Sensitive			0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
8760-HOUR	3.65E-02	CARTWRT	7.15E-06	1.41E-05	1.90E-06	9.49E-07	3.65E-07	1.68E-06	8.76E-07	3.65E-07	2.34E-06	5.11E-07	6.13E-06	1.95E-05	6.57E-07	1.98E-04	6.22E-05	5.62E-06
8760-HOUR	1.66E-01	CHIMNEY	3.26E-05	6.41E-05	8.64E-06	4.32E-06	1.66E-06	7.64E-06	3.99E-06	1.66E-06	1.06E-05	2.33E-06	2.79E-05	8.87E-05	2.99E-06	9.00E-04	2.83E-04	2.56E-05
8760-HOUR	4.80E-02	BB_RANCH	9.41E-06	1.85E-05	2.50E-06	1.25E-06	4.80E-07	2.21E-06	1.15E-06	4.80E-07	3.07E-06	6.72E-07	8.07E-06	2.56E-05	8.64E-07	2.60E-04	8.18E-05	7.39E-06
8760-HOUR	2.91E-01	RH_CRK	5.70E-05	1.12E-04	1.51E-05	7.57E-06	2.91E-06	1.34E-05	6.99E-06	2.91E-06	1.86E-05	4.07E-06	4.89E-05	1.55E-04	5.24E-06	1.58E-03	4.96E-04	4.48E-05
8760-HOUR	4.52E-02	CTRT_CRK	8.86E-06	1.75E-05	2.35E-06	1.18E-06	4.52E-07	2.08E-06	1.09E-06	4.52E-07	2.89E-06	6.33E-07	7.60E-06	2.41E-05	8.14E-07	2.45E-04	7.70E-05	6.96E-06
8760-HOUR	1.82E-01	OLDM_RF	3.56E-05	7.02E-05	9.45E-06	4.73E-06	1.82E-06	8.36E-06	4.36E-06	1.82E-06	1.16E-05	2.55E-06	3.05E-05	9.71E-05	3.27E-06	9.85E-04	3.10E-04	2.80E-05
8760-HOUR	7.30E-01	LVST_F	1.43E-04	2.82E-04	3.80E-05	1.90E-05	7.30E-06	3.36E-05	1.75E-05	7.30E-06	4.67E-05	1.02E-05	1.23E-04	3.90E-04	1.31E-05	3.96E-03	1.24E-03	1.12E-04
8760-HOUR	3.38E-01	PLT_MC	6.63E-05	1.30E-04	1.76E-05	3.79E-06	3.38E-06	1.55E-05	8.11E-06	3.38E-06	2.16E-05	4.73E-06	5.68E-05	1.81E-04	6.08E-06	1.83E-03	5.76E-04	5.21E-05
8760-HOUR	4.80E-02	C_GARDN	9.41E-06	1.85E-05	2.50E-06	1.25E-06	4.80E-07	2.21E-06	1.15E-06	4.80E-07	3.07E-06	6.72E-07	8.06E-06	2.56E-05	8.64E-07	2.60E-04	8.18E-05	7.39E-06
8760-HOUR	4.44E-02	S_GARDN	8.70E-06	1.71E-05	2.31E-06	1.15E-06	4.44E-07	2.04E-06	1.07E-06	4.44E-07	2.84E-06	6.22E-07	7.46E-06	2.37E-05	7.99E-07	2.41E-04	7.57E-05	6.84E-06
8760-HOUR	6.23E-02	RLND_MB	1.22E-05	2.41E-05	3.24E-06	1.62E-06	6.23E-07	2.87E-06	1.50E-06	6.23E-07	3.99E-06	8.73E-07	1.05E-05	3.33E-05	1.12E-06	3.38E-04	1.06E-04	9.60E-06
8760-HOUR	1.25E-01	R_BLAKE	2.46E-05	4.84E-05	6.53E-06	3.26E-06	1.25E-06	5.77E-06	3.01E-06	1.25E-06	8.03E-06	1.76E-06	2.11E-05	6.70E-05	2.26E-06	6.80E-04	2.14E-04	1.93E-05
8760-HOUR	1.21E-01	B_RANSOM	2.38E-05	4.68E-05	6.31E-06	3.15E-06	1.21E-06	5.58E-06	2.91E-06	1.21E-06	7.76E-06	1.70E-06	2.04E-05	6.48E-05	2.18E-06	6.58E-04	2.07E-04	1.87E-05
8760-HOUR	1.09E-01	RCKP_PLC	2.13E-05	4.20E-05	5.65E-06	2.83E-06	1.09E-06	5.00E-06	2.61E-06	1.09E-06	6.96E-06	1.52E-06	1.83E-05	5.81E-05	1.96E-06	5.89E-04	1.85E-04	1.67E-05
8760-HOUR	1.57E-01	S_HARVEY	3.07E-05	6.05E-05	8.15E-06	4.07E-06	1.57E-06	7.21E-06	3.76E-06	1.57E-06	1.00E-05	2.19E-06	2.63E-05	8.37E-05	2.82E-06	8.49E-04	2.67E-04	2.41E-05
8760-HOUR	1.41E-01	R_DAVIS	2.76E-05	5.44E-05	7.32E-06	3.66E-06	1.41E-06	6.48E-06	3.38E-06	1.41E-06	9.01E-06	1.97E-06	2.37E-05	7.52E-05	2.53E-06	7.63E-04	2.40E-04	2.17E-05
8760-HOUR	1.48E-01	RESIDEN	2.91E-05	5.72E-05	7.71E-06	3.85E-06	1.48E-06	6.82E-06	3.56E-06	1.48E-06	9.49E-06	2.08E-06	2.49E-05	7.91E-05	2.67E-06	8.03E-04	2.53E-04	2.28E-05
8760-HOUR	1.47E-01	COCHLAN	2.89E-05	5.69E-05	7.66E-06	3.83E-06	1.47E-06	6.78E-06	3.54E-06	1.47E-06	9.43E-06	2.06E-06	2.48E-05	7.87E-05	2.65E-06	7.99E-04	2.51E-04	2.27E-05
8760-HOUR	5.86E-01	N_RCKP	1.15E-04	2.26E-04	3.05E-05	1.52E-05	5.86E-06	2.70E-05	1.41E-05	5.86E-06	3.75E-05	8.21E-06	9.85E-05	3.13E-04	1.05E-05	3.18E-03	9.99E-04	9.03E-05
8760-HOUR	1.37E-01	NW_RCKP	2.69E-05	5.30E-05	7.14E-06	3.57E-06	1.37E-06	6.32E-06	3.30E-06	1.37E-06	8.79E-06	1.92E-06	2.31E-05	7.73E-05	2.47E-06	7.44E-04	2.34E-04	2.11E-05
8760-HOUR	3.22E-01	S_RCKP	6.32E-05	1.24E-04	1.68E-05	8.38E-06	3.22E-06	1.48E-05	7.74E-06	3.22E-06	2.06E-05	4.51E-06	5.42E-05	1.72E-04	5.80E-06	1.75E-03	5.49E-04	4.96E-05
8760-HOUR	4.03E-01	E_RCKP	7.89E-05	1.55E-04	2.09E-05	1.05E-05	4.03E-06	1.85E-05	9.66E-06	4.03E-06	2.58E-05	5.64E-06	6.76E-05	2.15E-04	7.25E-06	2.18E-03	6.86E-04	6.20E-05
8760-HOUR	3.54E-01	W_RCKP	6.93E-05	1.36E-04	1.84E-05	9.19E-06	3.54E-06	1.63E-05	8.49E-06	3.54E-06	2.26E-05	4.95E-06	5.94E-05	1.89E-04	6.37E-06	1.92E-03	6.03E-04	5.45E-05
8760-HOUR	1.46E-01	WLDNRN_N	2.87E-05	5.65E-05	7.61E-06	3.81E-06	1.46E-06	6.73E-06	3.51E-06	1.46E-06	9.37E-06	2.05E-06	2.46E-05	7.82E-05	2.63E-06	7.93E-04	2.49E-04	2.25E-05
8760-HOUR	1.92E-01	WLDNRN_S	3.77E-05	7.43E-05	1.00E-05	5.00E-06	1.92E-06	8.85E-06	4.62E-06	1.92E-06	1.23E-05	2.69E-06	3.23E-05	1.03E-04	3.46E-06	1.04E-03	3.28E-04	2.96E-05
8760-HOUR	1.89E-01	BOB_BNB	3.71E-05	7.31E-05	9.85E-06	4.92E-06	1.89E-06	8.71E-06	4.55E-06	1.89E-06	1.21E-05	2.65E-06	3.18E-05	1.01E-04	3.41E-06	1.03E-03	3.23E-04	2.92E-05
8760-HOUR	3.78E-02	BLADE_R	7.40E-06	1.46E-05	1.96E-06	9.82E-07	3.78E-07	1.74E-06	9.06E-07	3.78E-07	2.42E-06	5.29E-07	6.34E-06	2.02E-05	6.80E-07	2.05E-04	6.44E-05	5.82E-06
8760-HOUR	2.59E-01	LVG_GAR	5.08E-05	1.00E-04	1.35E-05	6.73E-06	2.59E-06	1.19E-05	6.22E-06	2.59E-06	1.66E-05	3.63E-06	4.35E-05	1.38E-04	4.66E-06	1.40E-03	4.41E-04	3.99E-05
8760-HOUR	3.53E-01	OM_RVR	6.91E-05	1.36E-04	1.83E-05	9.17E-06	3.53E-06	1.62E-05	8.47E-06	3.53E-06	2.26E-05	4.94E-06	5.93E-05	1.88E-04	6.35E-06	1.91E-03	6.01E-04	5.43E-05
8760-HOUR	3.60E-01	ATRM_EN	7.05E-05	1.39E-04	1.87E-05	9.35E-06	3.60E-06	1.65E-05	8.63E-06	3.60E-06	2.30E-05	5.03E-06	6.04E-05	1.92E-04	6.47E-06	1.95E-03	6.13E-04	5.54E-05
8760-HOUR	2.80E-01	CBN_RDG	5.49E-05	1.08E-04	1.46E-05	7.28E-06	2.80E-06	1.29E-05	6.72E-06	2.80E-06	1.79E-05	3.92E-06	4.71E-05	1.50E-04	5.04E-06	1.52E-03	4.77E-04	4.31E-05
8760-HOUR	2.23E-01	CR_HM_EN	4.38E-05	8.63E-05	1.16E-05	5.81E-06	2.23E-06	1.03E-05	5.36E-06	2.23E-06	1.43E-05	3.13E-06	3.75E-05	1.19E-04	4.02E-06	1.21E-03	3.81E-04	3.44E-05
8760-HOUR	2.16E-01	HNMYMCRK	4.23E-05	8.33E-05	1.12E-05	5.61E-06	2.16E-06	9.92E-06	5.18E-06	2.16E-06	1.38E-05	3.02E-06	3.62E-05	1.15E-04	3.88E-06	1.17E-03	3.68E-04	3.32E-05
8760-HOUR	5.34E-01	BLADE_C	1.05E-04	2.06E-04	2.78E-05	1.39E-05	5.34E-06	2.46E-05	1.28E-05	5.34E-06	3.42E-05	7.48E-06	8.97E-05	2.85E-04	9.61E-06	2.89E-03	9.10E-04	8.22E-05
8760-HOUR	5.28E-01	MCLY_CRK	1.04E-04	2.04E-04	2.75E-05	1.37E-05	5.28E-06	2.43E-05	1.27E-05	5.28E-06	3.38E-05	7.40E-06	8.88E-05	2.82E-04	9.51E-06	2.86E-03	9.00E-04	8.14E-05
8760-HOUR	2.23E-01	DENNIS	4.38E-05	8.63E-05	1.16E-05	5.81E-06	2.23E-06	1.03E-05	5.36E-06	2.23E-06	1.43E-05	3.13E-06	3.75E-05	1.19E-04	4.02E-06	1.21E-03	3.81E-04	3.44E-05
8760-HOUR	5.39E-01	PLT_NE	1.06E-04	2.08E-04	2.80E-05	1.40E-05	5.39E-06	2.48E-05	1.29E-05	5.39E-06	3.45E-05	7.55E-06	9.06E-05	2.88E-04	9.71E-06	2.92E-03	9.19E-04	8.30E-05
8760-HOUR	1.25E-01	PLT_NW	2.45E-05	4.82E-05	6.50E-06	3.25E-06	1.25E-06	5.75E-06	3.00E-06	1.25E-06	8.00E-06	1.75E-06	2.10E-05	6.67E-05	2.25E-06	6.77E-04	2.13E-04	1.92E-05
8760-HOUR	1.57E+00	PLT_SW	3.07E-04	6.05E-04	8.15E-05	4.08E-05	1.57E-05	7.21E-05	3.76E-05	1.57E-05	1.00E-04	2.19E-05	2.63E-04	8.37E-04	2.82E-05	8.50E-03	2.67E-03	2.41E-04
8760-HOUR	5.76E-01	PLT_SE	1.13E-04	2.22E-04	3.00E-05	1.50E-05	5.76E-06	2.65E-05	1.38E-05	5.76E-06	3.69E-05	8.06E-06	9.68E-05	3.08E-04	1.04E-05	3.12E-03	9.82E-04	8.87E-05
8760-HOUR	1.76E-01	RCKP_E	3.45E-05	6.80E-05	9.16E-06	4.58E-06	1.76E-06	8.10E-06	4.23E-06	1.76E-06	1.13E-05	2.47E-06	2.96E-05	9.40E-05	3.17E-06	9.55E-04	3.00E-04	2.71E-05
8760-HOUR	4.20E-02	RCKP_NE	8.24E-06	1.62E-05	2.19E-06	1.09E-06	4.20E-07	1.93E-06	1.01E-06	4.20E-07	2.69E-06	5.89E-07	7.06E-06	2.25E-05	7.57E-07	2.28E-04	7.16E-05	6.47E-06
8760-HOUR	2.49E-02	RCKP_NW	4.87E-06	9.60E-06	1.29E-06	6.46E-07	2.49E-07	1.14E-06	5.97E-07	2.49E-07	1.59E-06	3.48E-07	4.18E-06	1.33E-05	4.48E-07	1.35E-04	4.24E-05	3.83E-06
8760-HOUR	1.08E+00	RCKP_SW	2.12E-04	4.17E-04	5.61E-05	2.81E-05	1.08E-05	4.97E-05	2.59E-05	1.08E-05	6.91E-05	1.51E-05	1.81E-04	5.76E-04	1.94E-05	5.85E-03	1.84E-03	1.66E-04
8760-HOUR	2.00E-01	RCKP_SE	3.92E-05	7.72E-05	1.04E-05	5.20E-06	2.00E-06	9.20E-06	4.80E-06	2.00E-06	1.28E-05	2.80E-06	3.36E-05	1.07E-04	3.60E-06	1.08E-03	3.41E-04	3.08E-05
8760-HOUR	4.13E-02	PLATEAU	8.10E-06	1.59E-05	2.15E-06	1.07E												

Appendix G. Pekisko Station Precipitation Data (1998-2007)

The Pekisko Group

Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies

Longitude	Latitude (y)	Station Name	Climate ID	Date/Time Year	Month	Total Precip (mm)	
-114.42	50.37	PEKISKO	3055119	May-98	1998	5	165.7
-114.42	50.37	PEKISKO	3055119	Jun-98	1998	6	362.7
-114.42	50.37	PEKISKO	3055119	Jul-98	1998	7	72.1
-114.42	50.37	PEKISKO	3055119	Aug-98	1998	8	75.5
-114.42	50.37	PEKISKO	3055119	Sep-98	1998	9	30.4
-114.42	50.37	PEKISKO	3055119	Oct-98	1998	10	10.5
-114.42	50.37	PEKISKO	3055119	Nov-98	1998	11	17.7
-114.42	50.37	PEKISKO	3055119	Dec-98	1998	12	24
-114.42	50.37	PEKISKO	3055119	Jan-99	1999	1	10.2
-114.42	50.37	PEKISKO	3055119	Feb-99	1999	2	4.1
-114.42	50.37	PEKISKO	3055119	Mar-99	1999	3	17.6
-114.42	50.37	PEKISKO	3055119	Apr-99	1999	4	74.7
-114.42	50.37	PEKISKO	3055119	May-99	1999	5	53.9
-114.42	50.37	PEKISKO	3055119	Jun-99	1999	6	102
-114.42	50.37	PEKISKO	3055119	Jul-99	1999	7	82.2
-114.42	50.37	PEKISKO	3055119	Aug-99	1999	8	70.5
-114.42	50.37	PEKISKO	3055119	Sep-99	1999	9	21
-114.42	50.37	PEKISKO	3055119	Oct-99	1999	10	22.2
-114.42	50.37	PEKISKO	3055119	Nov-99	1999	11	37.8
-114.42	50.37	PEKISKO	3055119	Dec-99	1999	12	
-114.42	50.37	PEKISKO	3055119	Jan-00	2000	1	6.4
-114.42	50.37	PEKISKO	3055119	Feb-00	2000	2	16.2
-114.42	50.37	PEKISKO	3055119	Mar-00	2000	3	46.9
-114.42	50.37	PEKISKO	3055119	Apr-00	2000	4	45
-114.42	50.37	PEKISKO	3055119	May-00	2000	5	
-114.42	50.37	PEKISKO	3055119	Jun-00	2000	6	103.6
-114.42	50.37	PEKISKO	3055119	Jul-00	2000	7	
-114.42	50.37	PEKISKO	3055119	Aug-00	2000	8	43.4
-114.42	50.37	PEKISKO	3055119	Sep-00	2000	9	78.3
-114.42	50.37	PEKISKO	3055119	Oct-00	2000	10	6.9
-114.42	50.37	PEKISKO	3055119	Nov-00	2000	11	3.1
-114.42	50.37	PEKISKO	3055119	Dec-00	2000	12	
-114.42	50.37	PEKISKO	3055119	01-Jan	2001	1	11.1
-114.42	50.37	PEKISKO	3055119	01-Feb	2001	2	14.2
-114.42	50.37	PEKISKO	3055119	01-Mar	2001	3	20.3
-114.42	50.37	PEKISKO	3055119	01-Apr	2001	4	99.1
-114.42	50.37	PEKISKO	3055119	01-May	2001	5	11.4
-114.42	50.37	PEKISKO	3055119	01-Jun	2001	6	
-114.42	50.37	PEKISKO	3055119	01-Jul	2001	7	33.1
-114.42	50.37	PEKISKO	3055119	01-Aug	2001	8	3.8
-114.42	50.37	PEKISKO	3055119	01-Sep	2001	9	19.4
-114.42	50.37	PEKISKO	3055119	01-Oct	2001	10	13.6
-114.42	50.37	PEKISKO	3055119	01-Nov	2001	11	20.1
-114.42	50.37	PEKISKO	3055119	01-Dec	2001	12	9
-114.42	50.37	PEKISKO	3055119	02-Jan	2002	1	30.2
-114.42	50.37	PEKISKO	3055119	02-Feb	2002	2	49.7
-114.42	50.37	PEKISKO	3055119	02-Mar	2002	3	40.5
-114.42	50.37	PEKISKO	3055119	02-Apr	2002	4	62
-114.42	50.37	PEKISKO	3055119	02-May	2002	5	115.2
-114.42	50.37	PEKISKO	3055119	02-Jun	2002	6	212.2
-114.42	50.37	PEKISKO	3055119	02-Jul	2002	7	48.2
-114.42	50.37	PEKISKO	3055119	02-Aug	2002	8	86.1
-114.42	50.37	PEKISKO	3055119	02-Sep	2002	9	83.8
-114.42	50.37	PEKISKO	3055119	02-Oct	2002	10	
-114.42	50.37	PEKISKO	3055119	02-Nov	2002	11	14.6
-114.42	50.37	PEKISKO	3055119	02-Dec	2002	12	12.9
-114.42	50.37	PEKISKO	3055119	03-Jan	2003	1	7.9
-114.42	50.37	PEKISKO	3055119	03-Feb	2003	2	27.9
-114.42	50.37	PEKISKO	3055119	03-Mar	2003	3	45.1
-114.42	50.37	PEKISKO	3055119	03-Apr	2003	4	97.9
-114.42	50.37	PEKISKO	3055119	03-May	2003	5	55.8
-114.42	50.37	PEKISKO	3055119	03-Jun	2003	6	65.7
-114.42	50.37	PEKISKO	3055119	03-Jul	2003	7	9.9
-114.42	50.37	PEKISKO	3055119	03-Aug	2003	8	35.9
-114.42	50.37	PEKISKO	3055119	03-Sep	2003	9	69.7
-114.42	50.37	PEKISKO	3055119	03-Oct	2003	10	28.7
-114.42	50.37	PEKISKO	3055119	03-Nov	2003	11	62.6
-114.42	50.37	PEKISKO	3055119	03-Dec	2003	12	9.7
-114.42	50.37	PEKISKO	3055119	04-Jan	2004	1	18.8
-114.42	50.37	PEKISKO	3055119	04-Feb	2004	2	3.4
-114.42	50.37	PEKISKO	3055119	04-Mar	2004	3	19.6
-114.42	50.37	PEKISKO	3055119	04-Apr	2004	4	30.6
-114.42	50.37	PEKISKO	3055119	04-May	2004	5	132.8
-114.42	50.37	PEKISKO	3055119	04-Jun	2004	6	85.3
-114.42	50.37	PEKISKO	3055119	04-Jul	2004	7	100.4
-114.42	50.37	PEKISKO	3055119	04-Aug	2004	8	150.7
-114.42	50.37	PEKISKO	3055119	04-Sep	2004	9	33.5
-114.42	50.37	PEKISKO	3055119	04-Oct	2004	10	60.7
-114.42	50.37	PEKISKO	3055119	04-Nov	2004	11	14.6
-114.42	50.37	PEKISKO	3055119	04-Dec	2004	12	28.9
-114.42	50.37	PEKISKO	3055119	05-Jan	2005	1	33.2
-114.42	50.37	PEKISKO	3055119	05-Feb	2005	2	17.1
-114.42	50.37	PEKISKO	3055119	05-Mar	2005	3	41.6
-114.42	50.37	PEKISKO	3055119	05-Apr	2005	4	32.4
-114.42	50.37	PEKISKO	3055119	05-May	2005	5	48.6
-114.42	50.37	PEKISKO	3055119	05-Jun	2005	6	490.1
-114.42	50.37	PEKISKO	3055119	05-Jul	2005	7	49.6
-114.42	50.37	PEKISKO	3055119	05-Aug	2005	8	145.3
-114.42	50.37	PEKISKO	3055119	05-Sep	2005	9	178.3
-114.42	50.37	PEKISKO	3055119	05-Oct	2005	10	116
-114.42	50.37	PEKISKO	3055119	05-Nov	2005	11	25.9
-114.42	50.37	PEKISKO	3055119	05-Dec	2005	12	15.6
-114.42	50.37	PEKISKO	3055119	06-Jan	2006	1	11.2
-114.42	50.37	PEKISKO	3055119	06-Feb	2006	2	22.3
-114.42	50.37	PEKISKO	3055119	06-Mar	2006	3	10.6
-114.42	50.37	PEKISKO	3055119	06-Apr	2006	4	0
-114.42	50.37	PEKISKO	3055119	06-May	2006	5	62.5
-114.42	50.37	PEKISKO	3055119	06-Jun	2006	6	179.8
-114.42	50.37	PEKISKO	3055119	06-Jul	2006	7	17.4
-114.42	50.37	PEKISKO	3055119	06-Aug	2006	8	40.3
-114.42	50.37	PEKISKO	3055119	06-Sep	2006	9	64.1
-114.42	50.37	PEKISKO	3055119	06-Oct	2006	10	37.3
-114.42	50.37	PEKISKO	3055119	06-Nov	2006	11	31.9
-114.42	50.37	PEKISKO	3055119	06-Dec	2006	12	8.2
-114.42	50.37	PEKISKO	3055119	07-Jan	2007	1	14
-114.42	50.37	PEKISKO	3055119	07-Feb	2007	2	33
-114.42	50.37	PEKISKO	3055119	07-Mar	2007	3	46.3
-114.42	50.37	PEKISKO	3055119	07-Apr	2007	4	53.3
-114.42	50.37	PEKISKO	3055119	07-May	2007	5	73.2
-114.42	50.37	PEKISKO	3055119	07-Jun	2007	6	109.5
-114.42	50.37	PEKISKO	3055119	07-Jul	2007	7	12.8
-114.42	50.37	PEKISKO	3055119	07-Aug	2007	8	64
-114.42	50.37	PEKISKO	3055119	07-Sep	2007	9	72.8
-114.42	50.37	PEKISKO	3055119	07-Oct	2007	10	25.9
-114.42	50.37	PEKISKO	3055119	07-Nov	2007	11	23.1

Appendix H. Predicted Trace Element, Heavy Metal and PAH Deposition and Soil Concentrations

The Pekisko Group
Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies

S50 TSP - Concentration: [ug/m**3]			Dry deposition (ug/m2/s)																		
Average Period	100th Percentile (1st Highest)	Receptor ID	n/a	1.28E-06	3.15E-06	1.85E-04	1.00E-06	1.34E-06	1.10E-05	9.20E-06	2.90E-05	1.37E-05	n/a	1.14E-07	2.10E-06	3.05E-05	1.22E-06	5.00E-07	2.00E-06	4.00E-05	1.61E-04
Max			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
8760-HOUR	1.80E+03	716	#VALUE!	2.301E-05	5.662E-05	0.003325	1.8E-05	2.409E-05	0.000198	0.000165	0.000521	0.000246	#VALUE!	2.0492E-06	3.7748E-05	0.000548	2.193E-05	8.99E-06	3.6E-05	0.000719	0.002894
Sensitive			#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0
8760-HOUR	1.27E-01	CARTWRT	#VALUE!	1.631E-09	4.014E-09	2.36E-07	1.27E-09	1.708E-09	1.4E-08	1.17E-08	3.7E-08	1.75E-08	#VALUE!	1.4528E-10	2.6762E-09	3.89E-08	1.555E-09	6.37E-10	2.55E-09	5.1E-08	2.05E-07
8760-HOUR	1.36E+00	CHIMNEY	#VALUE!	1.744E-08	4.291E-08	2.52E-06	1.36E-08	1.826E-08	1.5E-07	1.25E-07	3.95E-07	1.87E-07	#VALUE!	1.5531E-09	2.8609E-08	4.16E-07	1.662E-08	6.81E-09	2.72E-08	5.45E-07	2.19E-06
8760-HOUR	2.16E-01	BB_RANCH	#VALUE!	2.762E-09	6.796E-09	3.99E-07	2.16E-09	2.891E-09	2.37E-08	1.98E-08	6.26E-08	2.96E-08	#VALUE!	2.4595E-10	4.5307E-09	6.58E-08	2.632E-09	1.08E-09	4.31E-09	8.63E-08	3.47E-07
8760-HOUR	2.35E+00	RH_CRK	#VALUE!	3.006E-08	7.398E-08	4.35E-06	2.35E-08	3.147E-08	2.58E-07	2.16E-07	6.81E-07	3.22E-07	#VALUE!	2.6775E-09	4.9322E-08	7.16E-07	2.865E-08	1.17E-08	4.7E-08	9.39E-07	3.78E-06
8760-HOUR	1.38E-01	CTRT_CRK	#VALUE!	1.768E-09	4.351E-09	2.56E-07	1.38E-09	1.851E-09	1.52E-08	1.27E-08	4.01E-08	1.89E-08	#VALUE!	1.5746E-10	2.9005E-09	4.21E-08	1.685E-09	6.91E-10	2.76E-09	5.52E-08	2.22E-07
8760-HOUR	1.20E+00	OLDM_RF	#VALUE!	1.54E-08	3.791E-08	2.23E-06	1.2E-08	1.613E-08	1.32E-07	1.11E-07	3.49E-07	1.65E-07	#VALUE!	1.372E-09	2.5273E-08	3.67E-07	1.468E-08	6.02E-09	2.41E-08	4.81E-07	1.94E-06
8760-HOUR	9.55E+00	LVST_F	#VALUE!	1.223E-07	3.01E-07	1.77E-05	9.55E-08	1.28E-07	1.05E-06	8.79E-07	2.77E-06	1.31E-06	#VALUE!	1.0892E-08	2.0064E-07	2.91E-06	1.166E-07	4.78E-08	1.91E-07	3.82E-06	1.54E-05
8760-HOUR	3.14E+00	PLT_MC	#VALUE!	4.016E-08	9.882E-08	5.8E-06	3.14E-08	4.204E-08	3.45E-07	2.89E-07	9.1E-07	4.3E-07	#VALUE!	3.5765E-09	6.5882E-08	9.57E-07	3.827E-08	1.57E-08	6.27E-08	1.25E-06	5.05E-06
8760-HOUR	2.16E-01	C_GARDN	#VALUE!	2.761E-09	6.794E-09	3.99E-07	2.16E-09	2.89E-09	2.37E-08	1.98E-08	6.25E-08	2.95E-08	#VALUE!	2.4588E-10	4.5293E-09	6.58E-08	2.631E-09	1.08E-09	4.31E-09	8.63E-08	3.47E-07
8760-HOUR	1.86E-01	S_GARDN	#VALUE!	2.382E-09	5.861E-09	3.44E-07	1.86E-09	2.493E-09	2.05E-08	1.71E-08	5.4E-08	2.55E-08	#VALUE!	2.1211E-10	3.9073E-09	5.67E-08	2.27E-09	9.3E-10	3.72E-09	7.44E-08	3E-07
8760-HOUR	3.71E-01	RLND_MB	#VALUE!	4.744E-09	1.167E-08	6.86E-07	3.71E-09	4.966E-09	4.08E-08	3.41E-08	1.07E-07	5.08E-08	#VALUE!	4.2248E-10	7.7826E-09	1.13E-07	4.521E-09	1.85E-09	7.41E-09	1.48E-07	5.97E-07
8760-HOUR	1.03E+00	R_BLAKE	#VALUE!	1.322E-08	3.253E-08	1.91E-06	1.03E-08	1.384E-08	1.14E-07	9.5E-08	2.99E-07	1.41E-07	#VALUE!	1.1773E-09	2.1688E-08	3.15E-07	1.26E-08	5.16E-09	2.07E-08	4.13E-07	1.66E-06
8760-HOUR	9.83E-01	B_RANSOM	#VALUE!	1.259E-08	3.097E-08	1.82E-06	9.83E-09	1.318E-08	1.08E-07	9.05E-08	2.85E-07	1.35E-07	#VALUE!	1.121E-09	2.065E-08	3E-07	1.2E-08	4.92E-09	1.97E-08	3.93E-07	1.58E-06
8760-HOUR	8.42E-01	RCKP_PLD	#VALUE!	1.078E-08	2.652E-08	1.56E-06	8.42E-09	1.128E-08	9.26E-08	7.75E-08	2.44E-07	1.15E-07	#VALUE!	9.5994E-10	1.7683E-08	2.57E-07	1.027E-08	4.21E-09	1.68E-08	3.37E-07	1.36E-06
8760-HOUR	1.27E+00	S_HARVEY	#VALUE!	1.622E-08	3.992E-08	2.34E-06	1.27E-08	1.698E-08	1.39E-07	1.17E-07	3.68E-07	1.74E-07	#VALUE!	1.4448E-09	2.6615E-08	3.87E-07	1.546E-08	6.34E-09	2.53E-08	5.07E-07	2.04E-06
8760-HOUR	1.13E+00	R_DAVIS	#VALUE!	1.451E-08	3.571E-08	2.1E-06	1.13E-08	1.519E-08	1.25E-07	1.04E-07	3.29E-07	1.55E-07	#VALUE!	1.2923E-09	2.3806E-08	3.46E-07	1.383E-08	5.67E-09	2.27E-08	4.53E-07	1.83E-06
8760-HOUR	1.19E+00	RESIDEN	#VALUE!	1.525E-08	3.753E-08	2.2E-06	1.19E-08	1.596E-08	1.31E-07	1.1E-07	3.45E-07	1.63E-07	#VALUE!	1.3581E-09	2.5018E-08	3.63E-07	1.453E-08	5.96E-09	2.38E-08	4.77E-07	1.92E-06
8760-HOUR	1.18E+00	COCHLAN	#VALUE!	1.515E-08	3.729E-08	2.19E-06	1.18E-08	1.586E-08	1.3E-07	1.09E-07	3.43E-07	1.62E-07	#VALUE!	1.3496E-09	2.4861E-08	3.61E-07	1.444E-08	5.92E-09	2.37E-08	4.74E-07	1.91E-06
8760-HOUR	7.26E+00	N_RCKP	#VALUE!	9.295E-08	2.287E-07	1.34E-05	7.26E-08	9.73E-08	7.99E-07	6.68E-07	2.11E-06	9.95E-07	#VALUE!	8.2781E-09	1.5249E-07	2.21E-06	8.859E-08	3.63E-08	1.45E-07	2.9E-06	1.17E-05
8760-HOUR	7.18E-01	NW_RCKP	#VALUE!	9.193E-09	2.262E-08	1.33E-06	7.18E-09	9.624E-09	7.9E-08	6.61E-08	2.08E-07	9.84E-08	#VALUE!	8.1878E-10	1.5083E-08	2.19E-07	8.762E-09	3.59E-09	1.44E-08	2.87E-07	1.16E-06
8760-HOUR	2.98E+00	S_RCKP	#VALUE!	3.811E-08	9.379E-08	5.51E-06	2.98E-08	3.99E-08	3.28E-07	2.74E-07	8.63E-07	4.08E-07	#VALUE!	3.3944E-09	6.2528E-08	9.08E-07	3.633E-08	1.49E-08	5.96E-08	1.19E-06	4.79E-06
8760-HOUR	4.10E+00	E_RCKP	#VALUE!	5.253E-08	1.293E-07	7.59E-06	4.1E-08	5.5E-08	4.51E-07	3.78E-07	1.19E-06	5.62E-07	#VALUE!	4.6788E-09	8.6189E-08	1.25E-06	5.007E-08	2.05E-08	8.21E-08	1.64E-06	6.61E-06
8760-HOUR	3.50E+00	W_RCKP	#VALUE!	4.479E-08	1.102E-07	6.47E-06	3.5E-08	4.689E-08	3.85E-07	3.22E-07	1.01E-06	4.79E-07	#VALUE!	3.9891E-09	7.3484E-08	1.07E-06	4.269E-08	1.75E-08	7E-08	1.4E-06	5.63E-06
8760-HOUR	1.07E+00	WLDNR_N	#VALUE!	1.372E-08	3.377E-08	1.98E-06	1.07E-08	1.437E-08	1.18E-07	9.86E-08	3.11E-07	1.47E-07	#VALUE!	1.2222E-09	2.2514E-08	3.27E-07	1.308E-08	5.36E-09	2.14E-08	4.29E-07	1.73E-06
8760-HOUR	1.56E+00	WLDNR_S	#VALUE!	1.992E-08	4.902E-08	2.88E-06	1.56E-08	2.085E-08	1.71E-07	1.43E-07	4.51E-07	2.13E-07	#VALUE!	1.7742E-09	3.2683E-08	4.75E-07	1.899E-08	7.78E-09	3.11E-08	6.23E-07	2.51E-06
8760-HOUR	1.40E+00	BOB_BNB	#VALUE!	1.792E-08	4.411E-08	2.59E-06	1.4E-08	1.876E-08	1.54E-07	1.29E-07	4.06E-07	1.92E-07	#VALUE!	1.5962E-09	2.9404E-08	4.27E-07	1.708E-08	7E-09	2.8E-08	5.6E-07	2.25E-06
8760-HOUR	1.60E-01	BLADE_R	#VALUE!	2.049E-09	5.043E-09	2.96E-07	1.6E-09	2.145E-09	1.76E-08	1.47E-08	4.64E-08	2.19E-08	#VALUE!	1.8252E-10	3.3622E-09	4.88E-08	1.953E-09	8.01E-10	3.2E-09	6.4E-08	2.58E-07
8760-HOUR	2.00E+00	LVG_GAP	#VALUE!	2.559E-08	6.298E-08	3.7E-06	2E-08	2.679E-08	2.2E-07	1.84E-07	5.8E-07	2.74E-07	#VALUE!	2.2794E-09	4.1989E-08	6.1E-07	2.439E-08	1E-08	4E-08	8E-07	3.22E-06
8760-HOUR	3.44E+00	OM_RVR	#VALUE!	4.406E-08	1.084E-07	6.37E-06	3.44E-08	4.613E-08	3.79E-07	3.17E-07	9.98E-07	4.72E-07	#VALUE!	3.9242E-09	7.2287E-08	1.05E-06	4.2E-08	1.72E-08	6.88E-08	1.38E-06	5.54E-06
8760-HOUR	3.39E+00	ATRM_EN	#VALUE!	4.434E-08	1.069E-07	6.28E-06	3.39E-08	4.546E-08	3.73E-07	3.12E-07	9.84E-07	4.65E-07	#VALUE!	3.8677E-09	7.1248E-08	1.03E-06	4.139E-08	1.7E-08	6.79E-08	1.36E-06	5.46E-06
8760-HOUR	2.22E+00	CBN_RDG	#VALUE!	2.844E-08	6.999E-08	4.11E-06	2.22E-08	2.977E-08	2.44E-07	2.04E-07	6.44E-07	3.04E-07	#VALUE!	2.5331E-09	4.6662E-08	6.78E-07	2.711E-08	1.11E-08	4.44E-08	8.89E-07	3.58E-06
8760-HOUR	1.92E+00	CR_HM_EN	#VALUE!	2.46E-08	6.054E-08	3.56E-06	1.92E-08	2.575E-08	2.11E-07	1.77E-07	5.57E-07	2.63E-07	#VALUE!	2.191E-09	4.0361E-08	5.86E-07	2.345E-08	9.61E-09	3.84E-08	7.69E-07	3.09E-06
8760-HOUR	1.74E+00	HNMYNCRK	#VALUE!	2.227E-08	5.481E-08	3.22E-06	1.74E-08	2.331E-08	1.91E-07	1.6E-07	5.05E-07	2.38E-07	#VALUE!	1.9835E-09	3.6538E-08	5.31E-07	2.123E-08	8.7E-09	3.48E-08	6.96E-07	2.8E-06
8760-HOUR	6.05E+00	BLADE_C	#VALUE!	7.742E-08	1.905E-07	1.12E-05	6.05E-08	8.105E-08	6.65E-07	5.56E-07	1.75E-06	8.29E-07	#VALUE!	6.895E-09	1.2701E-07	1.84E-06	7.379E-08	3.02E-08	1.21E-07	2.42E-06	9.74E-06
8760-HOUR	5.98E+00	MCLY_CRK	#VALUE!	7.657E-08	1.884E-07	1.11E-05	5.98E-08	8.016E-08	6.58E-07	5.5E-07	1.7										

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S50 TSP - Concentration: [ug/m**3]			Wet deposition (ug/m2/s)																		
Average Period	100th Percentile (1st Highest)	Receptor ID	n/a	1.28E-06	3.15E-06	1.85E-04	1.00E-06	1.34E-06	1.10E-05	9.20E-06	2.90E-05	1.37E-05	n/a	1.14E-07	2.10E-06	3.05E-05	1.22E-06	5.00E-07	2.00E-06	4.00E-05	1.61E-04
Max			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium m	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
8760-HOUR	1.80E+03	716	#VALUE!	1.426E-10	3.51E-10	2.06E-08	1.11E-10	1.493E-10	1.23E-09	1.03E-09	3.23E-09	1.53E-09	#VALUE!	1.2701E-11	2.3397E-10	3.4E-09	1.359E-10	5.57E-11	2.23E-10	4.46E-09	1.79E-08
Sensitive			#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0
8760-HOUR	1.27E-01	CARTWRT	#VALUE!	1.011E-14	2.488E-14	1.46E-12	7.9E-15	1.058E-14	8.69E-14	7.27E-14	2.29E-13	1.08E-13	#VALUE!	9.0048E-16	1.6588E-14	2.41E-13	9.637E-15	3.95E-15	1.58E-14	3.16E-13	1.27E-12
8760-HOUR	1.36E+00	CHIMNEY	#VALUE!	1.081E-13	2.66E-13	1.56E-11	8.44E-14	1.132E-13	9.29E-13	7.77E-13	2.45E-12	1.16E-12	#VALUE!	9.6262E-15	1.7732E-13	2.58E-12	1.03E-13	4.22E-14	1.69E-13	3.38E-12	1.36E-11
8760-HOUR	2.16E-01	BB_RANCH	#VALUE!	1.712E-14	4.212E-14	2.47E-12	1.34E-14	1.792E-14	1.47E-13	1.23E-13	3.88E-13	1.83E-13	#VALUE!	1.5244E-15	2.8082E-14	4.08E-13	1.631E-14	6.69E-15	2.67E-14	5.35E-13	2.15E-12
8760-HOUR	2.35E+00	RH_CRK	#VALUE!	1.863E-13	4.586E-13	2.69E-11	1.46E-13	1.951E-13	1.6E-12	1.34E-12	4.22E-12	1.99E-12	#VALUE!	1.6595E-14	3.057E-13	4.44E-12	1.776E-13	7.28E-14	2.91E-13	5.82E-12	2.34E-11
8760-HOUR	1.38E-01	CTRT_CRK	#VALUE!	1.096E-14	2.697E-14	1.58E-12	8.56E-15	1.147E-14	9.42E-14	7.88E-14	2.48E-13	1.17E-13	#VALUE!	9.7594E-16	1.7978E-14	2.61E-13	1.044E-14	4.28E-15	1.71E-14	3.42E-13	1.38E-12
8760-HOUR	1.20E+00	OLDM_RF	#VALUE!	9.548E-14	2.35E-13	1.38E-11	7.46E-14	9.995E-14	8.21E-13	6.86E-13	2.16E-12	1.02E-12	#VALUE!	8.5036E-15	1.5665E-13	2.28E-12	9.1E-14	3.73E-14	1.49E-13	2.98E-12	1.2E-11
8760-HOUR	9.55E+00	LVST_F	#VALUE!	7.58E-13	1.865E-12	1.1E-10	5.92E-13	7.935E-13	6.51E-12	5.45E-12	1.72E-11	8.11E-12	#VALUE!	6.7509E-14	1.2436E-12	1.81E-11	7.225E-13	2.96E-13	1.18E-12	2.37E-11	9.53E-11
8760-HOUR	3.14E+00	PLT_MC	#VALUE!	2.489E-13	6.125E-13	3.6E-11	1.94E-13	2.606E-13	2.14E-12	1.79E-12	5.64E-12	2.66E-12	#VALUE!	2.2167E-14	4.0835E-13	5.93E-12	2.372E-13	9.72E-14	3.89E-13	7.78E-12	3.13E-11
8760-HOUR	2.16E-01	C_GARDN	#VALUE!	1.711E-14	4.211E-14	2.47E-12	1.34E-14	1.791E-14	1.47E-13	1.23E-13	3.88E-13	1.83E-13	#VALUE!	1.524E-15	2.8073E-14	4.08E-13	1.631E-14	6.68E-15	2.67E-14	5.35E-13	2.15E-12
8760-HOUR	1.86E-01	S_GARDN	#VALUE!	1.476E-14	3.633E-14	2.13E-12	1.15E-14	1.545E-14	1.27E-13	1.06E-13	3.34E-13	1.58E-13	#VALUE!	1.3147E-15	2.4218E-14	3.52E-13	1.407E-14	5.77E-15	2.31E-14	4.61E-13	1.86E-12
8760-HOUR	3.71E-01	RLND_MB	#VALUE!	2.94E-14	7.236E-14	4.25E-12	2.3E-14	3.078E-14	2.53E-13	2.11E-13	6.66E-13	3.15E-13	#VALUE!	2.6186E-15	4.8238E-14	7.01E-13	2.802E-14	1.15E-14	4.59E-14	9.19E-13	3.7E-12
8760-HOUR	1.03E+00	R_BLAKE	#VALUE!	8.193E-14	2.016E-13	1.18E-11	6.4E-14	8.578E-14	7.04E-13	5.89E-13	1.86E-12	8.77E-13	#VALUE!	7.2973E-15	1.3442E-13	1.95E-12	7.809E-14	3.2E-14	1.28E-13	2.56E-12	1.03E-11
8760-HOUR	9.83E-01	B_RANSOM	#VALUE!	7.801E-14	1.92E-13	1.13E-11	6.09E-14	8.167E-14	6.7E-13	5.61E-13	1.77E-12	8.35E-13	#VALUE!	6.9481E-15	1.2799E-13	1.86E-12	7.436E-14	3.05E-14	1.22E-13	2.44E-12	9.81E-12
8760-HOUR	8.42E-01	RCKP_PLC	#VALUE!	6.681E-14	1.644E-13	9.66E-12	5.22E-14	6.994E-14	5.74E-13	4.8E-13	1.51E-12	7.15E-13	#VALUE!	5.9498E-15	1.096E-13	1.59E-12	6.367E-14	2.61E-14	1.04E-13	2.09E-12	8.4E-12
8760-HOUR	1.27E+00	S_HARVEY	#VALUE!	1.006E-13	2.474E-13	1.45E-11	7.86E-14	1.053E-13	8.64E-13	7.23E-13	2.28E-12	1.08E-12	#VALUE!	8.9553E-15	1.6497E-13	2.4E-12	9.584E-14	3.93E-14	1.57E-13	3.14E-12	1.26E-11
8760-HOUR	1.13E+00	R_DAVIS	#VALUE!	8.994E-14	2.213E-13	1.3E-11	7.03E-14	9.415E-14	7.73E-13	6.46E-13	2.04E-12	9.63E-13	#VALUE!	8.0099E-15	1.4755E-13	2.14E-12	8.572E-14	3.51E-14	1.41E-13	2.81E-12	1.13E-11
8760-HOUR	1.19E+00	RESIDEN	#VALUE!	9.452E-14	2.326E-13	1.37E-11	7.38E-14	9.895E-14	8.12E-13	6.79E-13	2.14E-12	1.01E-12	#VALUE!	8.4178E-15	1.5506E-13	2.25E-12	9.008E-14	3.69E-14	1.48E-13	2.95E-12	1.19E-11
8760-HOUR	1.18E+00	COCHLAN	#VALUE!	9.392E-14	2.311E-13	1.36E-11	7.34E-14	9.832E-14	8.07E-13	6.75E-13	2.13E-12	1.01E-12	#VALUE!	8.3649E-15	1.5409E-13	2.24E-12	8.952E-14	3.67E-14	1.47E-13	2.94E-12	1.18E-11
8760-HOUR	7.26E+00	N_RCKP	#VALUE!	5.761E-13	1.418E-12	8.33E-11	4.5E-13	6.031E-13	4.95E-12	4.14E-12	1.31E-11	6.17E-12	#VALUE!	5.1309E-14	9.4516E-13	1.37E-11	5.491E-13	2.25E-13	9E-13	1.8E-11	7.25E-11
8760-HOUR	7.18E-01	NW_RCKP	#VALUE!	5.698E-14	1.402E-13	8.24E-12	4.45E-14	5.965E-14	4.9E-13	4.1E-13	1.29E-12	6.1E-13	#VALUE!	5.0749E-15	9.3485E-14	1.36E-12	5.431E-14	2.23E-14	8.9E-14	1.78E-12	7.17E-12
8760-HOUR	2.98E+00	S_RCKP	#VALUE!	2.362E-13	5.813E-13	3.41E-11	1.85E-13	2.473E-13	2.03E-12	1.7E-12	5.35E-12	2.53E-12	#VALUE!	2.1039E-14	3.8755E-13	5.63E-12	2.252E-13	9.23E-14	3.69E-13	7.38E-12	2.97E-11
8760-HOUR	4.10E+00	E_RCKP	#VALUE!	3.256E-13	8.013E-13	4.71E-11	2.54E-13	3.409E-13	2.8E-12	2.34E-12	7.38E-12	3.49E-12	#VALUE!	2.9E-14	5.3421E-13	7.76E-12	3.104E-13	1.27E-13	5.09E-13	1.02E-11	4.1E-11
8760-HOUR	3.50E+00	W_RCKP	#VALUE!	2.776E-13	6.832E-13	4.01E-11	2.17E-13	2.906E-13	2.39E-12	2E-12	6.29E-12	2.97E-12	#VALUE!	2.4725E-14	4.5547E-13	6.62E-12	2.646E-13	1.08E-13	4.34E-13	8.68E-12	3.49E-11
8760-HOUR	1.07E+00	WLDRN_N	#VALUE!	8.506E-14	2.093E-13	1.23E-11	6.65E-14	8.904E-14	7.31E-13	6.11E-13	1.93E-12	9.1E-13	#VALUE!	7.5753E-15	1.3955E-13	2.03E-12	8.107E-14	3.32E-14	1.33E-13	2.66E-12	1.07E-11
8760-HOUR	1.56E+00	WLDRN_S	#VALUE!	1.235E-13	3.039E-13	1.78E-11	9.65E-14	1.293E-13	1.06E-12	8.87E-13	2.8E-12	1.32E-12	#VALUE!	1.0997E-14	2.0257E-13	2.94E-12	1.177E-13	4.82E-14	1.93E-13	3.86E-12	1.55E-11
8760-HOUR	1.40E+00	BOB_BNB	#VALUE!	1.111E-13	2.734E-13	1.61E-11	8.68E-14	1.163E-13	9.55E-13	7.98E-13	2.52E-12	1.19E-12	#VALUE!	9.8936E-15	1.8225E-13	2.65E-12	1.009E-13	4.34E-14	1.74E-13	3.47E-12	1.4E-11
8760-HOUR	1.60E-01	BLADE_R	#VALUE!	1.27E-14	3.126E-14	1.84E-12	9.92E-15	1.33E-14	1.09E-13	9.13E-14	2.88E-13	1.36E-13	#VALUE!	1.1313E-15	2.0839E-14	3.03E-13	1.211E-14	4.96E-15	1.98E-14	3.97E-13	1.6E-12
8760-HOUR	2.00E+00	LVG_GAP	#VALUE!	1.586E-13	3.904E-13	2.29E-11	1.24E-13	1.661E-13	1.36E-12	1.14E-12	3.59E-12	1.7E-12	#VALUE!	1.4128E-14	2.6025E-13	3.78E-12	1.512E-13	6.2E-14	2.48E-13	4.96E-12	2E-11
8760-HOUR	3.44E+00	OM_RVR	#VALUE!	2.731E-13	6.721E-13	3.95E-11	2.13E-13	2.859E-13	2.35E-12	1.96E-12	6.19E-12	2.92E-12	#VALUE!	2.4323E-14	4.4805E-13	6.51E-12	2.603E-13	1.07E-13	4.27E-13	8.53E-12	3.44E-11
8760-HOUR	3.39E+00	ATRM_EN	#VALUE!	2.692E-13	6.624E-13	3.89E-11	2.1E-13	2.818E-13	2.31E-12	1.93E-12	6.1E-12	2.88E-12	#VALUE!	2.3973E-14	4.416E-13	6.41E-12	2.566E-13	1.05E-13	4.21E-13	8.41E-12	3.39E-11
8760-HOUR	2.22E+00	CBN_RDG	#VALUE!	1.763E-13	4.338E-13	2.55E-11	1.38E-13	1.845E-13	1.51E-12	1.27E-12	3.99E-12	1.89E-12	#VALUE!	1.57E-14	2.8922E-13	4.2E-12	1.68E-13	6.89E-14	2.75E-13	5.51E-12	2.22E-11
8760-HOUR	1.92E+00	CR_HM_EN	#VALUE!	1.525E-13	3.752E-13	2.2E-11	1.19E-13	1.596E-13	1.31E-12	1.1E-12	3.45E-12	1.63E-12	#VALUE!	1.358E-14	2.5016E-13	3.63E-12	1.453E-13	5.96E-14	2.38E-13	4.77E-12	1.92E-11
8760-HOUR	1.74E+00	HNVMNCRK	#VALUE!	1.38E-13	3.397E-13	2E-11	1.08E-13	1.445E-13	1.19E-12	9.92E-13	3.13E-12	1.48E-12	#VALUE!	1.2294E-14	2.2647E-13	3.29E-12	1.316E-13	5.39E-14	2.16E-13	4.31E-12	1.74E-11
8760-HOUR	6.05E+00	BLADE_C	#VALUE!	4.798E-13	1.181E-12	6.94E-11	3.75E-13	5.023E-13	4.12E-12	3.45E-12	1.09E-11	5.14E-12	#VALUE!	4.2736E-14	7.8725E-13	1.14E-11	4.574E-13	1.87			

The Pekisko Group
Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies

S50 TSP - Concentration: [ug/m ³]			Total deposition (D10t, ug/m2/year)																		
Average Period	100th Percentile (1st Highest)	Receptor ID	n/a	1.28E-06	3.15E-06	1.85E-04	1.00E-06	1.34E-06	1.10E-05	9.20E-06	2.90E-05	1.37E-05	n/a	1.14E-07	2.10E-06	3.05E-05	1.22E-06	5.00E-07	2.00E-06	4.00E-05	1.61E-04
Max			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
8760-HOUR	1.80E+03	716	#VALUE!	0.0045203	0.0111242	0.653327	0.003531	0.0047322	0.038846	0.03249	0.102413	0.048382	#VALUE!	0.00040259	0.00741615	0.107711	0.0043084	0.001766	0.007063	0.14126	0.568571
Sensitive			#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0
8760-HOUR	1.27E-01	CARTWRT	#VALUE!	3.205E-07	7.887E-07	4.63E-05	2.5E-07	3.355E-07	2.75E-06	2.3E-06	7.26E-06	3.43E-06	#VALUE!	2.8543E-08	5.2579E-07	7.64E-06	3.055E-07	1.25E-07	5.01E-07	1E-05	4.03E-05
8760-HOUR	1.36E+00	CHIMNEY	#VALUE!	3.426E-06	8.431E-06	0.000495	2.68E-06	3.587E-06	2.94E-05	2.46E-05	7.76E-05	3.67E-05	#VALUE!	3.0512E-07	5.6207E-06	8.16E-05	3.265E-06	1.34E-06	5.35E-06	0.000107	0.000431
8760-HOUR	2.16E-01	BB_RANCH	#VALUE!	5.425E-07	1.335E-06	7.84E-05	4.24E-07	5.68E-07	4.66E-06	3.9E-06	1.23E-05	5.81E-06	#VALUE!	4.8321E-08	8.9012E-07	1.29E-05	5.171E-07	2.12E-07	8.48E-07	1.7E-05	6.82E-05
8760-HOUR	2.35E+00	RH_CRK	#VALUE!	5.906E-06	1.453E-05	0.000854	4.61E-06	6.183E-06	5.08E-05	4.25E-05	0.000134	6.32E-05	#VALUE!	5.2603E-07	9.69E-06	0.000141	5.629E-06	2.31E-06	9.23E-06	0.000185	0.000743
8760-HOUR	1.38E-01	CTRT_CRK	#VALUE!	3.473E-07	8.548E-07	5.02E-05	2.71E-07	3.636E-07	2.98E-06	2.5E-06	7.87E-06	3.72E-06	#VALUE!	3.0935E-08	5.6985E-07	8.28E-06	3.311E-07	1.36E-07	5.43E-07	1.09E-05	4.37E-05
8760-HOUR	1.20E+00	OLDM_RF	#VALUE!	3.026E-06	7.448E-06	0.000437	2.36E-06	3.168E-06	2.6E-05	2.18E-05	6.86E-05	3.24E-05	#VALUE!	2.6954E-07	4.9652E-06	7.21E-05	2.885E-06	1.18E-06	4.73E-06	9.46E-05	0.000381
8760-HOUR	9.55E+00	LVST_F	#VALUE!	2.403E-05	5.913E-05	0.003473	1.88E-05	2.515E-05	0.000206	0.000173	0.000544	0.000257	#VALUE!	2.1399E-06	3.9418E-05	0.000573	2.29E-05	9.39E-06	3.75E-05	0.000751	0.003022
8760-HOUR	3.14E+00	PLT_MC	#VALUE!	7.889E-06	1.942E-05	0.00114	6.16E-06	8.259E-06	6.78E-05	5.67E-05	0.000179	8.44E-05	#VALUE!	7.0265E-07	1.2944E-05	0.000188	7.52E-06	3.08E-06	1.23E-05	0.000247	0.000992
8760-HOUR	2.16E-01	C_GARDN	#VALUE!	5.424E-07	1.335E-06	7.84E-05	4.24E-07	5.678E-07	4.66E-06	3.9E-06	1.23E-05	5.81E-06	#VALUE!	4.8306E-08	8.9895E-07	1.29E-05	5.17E-07	2.12E-07	8.47E-07	1.69E-05	6.82E-05
8760-HOUR	1.86E-01	S_GARDN	#VALUE!	4.679E-07	1.151E-06	6.76E-05	3.66E-07	4.898E-07	4.02E-06	3.36E-06	1.06E-05	5.01E-06	#VALUE!	4.1672E-08	7.6764E-07	1.11E-05	4.46E-07	1.83E-07	7.31E-07	1.46E-05	5.89E-05
8760-HOUR	3.71E-01	RLND_MB	#VALUE!	9.32E-07	2.294E-06	0.000135	7.28E-07	9.757E-07	8.01E-06	6.7E-06	2.11E-05	9.97E-06	#VALUE!	8.3003E-08	1.529E-06	2.22E-05	8.883E-07	3.64E-07	1.46E-06	2.91E-05	0.000117
8760-HOUR	1.03E+00	R_BLAKE	#VALUE!	2.597E-06	6.391E-06	0.000375	2.03E-06	2.719E-06	2.23E-05	1.87E-05	5.88E-05	2.78E-05	#VALUE!	2.313E-07	4.2609E-06	6.19E-05	2.475E-06	1.01E-06	4.06E-06	8.12E-05	0.000327
8760-HOUR	9.83E-01	B_RANSOM	#VALUE!	2.473E-06	6.085E-06	0.000357	1.93E-06	2.589E-06	2.13E-05	1.78E-05	5.6E-05	2.65E-05	#VALUE!	2.2023E-07	4.057E-06	5.89E-05	2.357E-06	9.66E-07	3.86E-06	7.73E-05	0.000311
8760-HOUR	8.42E-01	RCKP_PLC	#VALUE!	2.118E-06	5.211E-06	0.000306	1.65E-06	2.217E-06	1.82E-05	1.52E-05	4.8E-05	2.27E-05	#VALUE!	1.8859E-07	3.4741E-06	5.05E-05	2.018E-06	8.27E-07	3.31E-06	6.62E-05	0.000266
8760-HOUR	1.27E+00	S_HARVEY	#VALUE!	3.187E-06	7.843E-06	0.000461	2.49E-06	3.337E-06	2.74E-05	2.29E-05	7.22E-05	3.41E-05	#VALUE!	2.8386E-07	5.229E-06	7.59E-05	3.038E-06	1.24E-06	4.98E-06	9.96E-05	0.000401
8760-HOUR	1.13E+00	R_DAVIS	#VALUE!	2.851E-06	7.015E-06	0.000412	2.23E-06	2.984E-06	2.45E-05	2.05E-05	6.46E-05	3.05E-05	#VALUE!	2.5389E-07	4.677E-06	6.79E-05	2.717E-06	1.11E-06	4.45E-06	8.91E-05	0.000359
8760-HOUR	1.19E+00	RESIDEN	#VALUE!	2.996E-06	7.373E-06	0.000433	2.34E-06	3.136E-06	2.57E-05	2.15E-05	6.79E-05	3.21E-05	#VALUE!	2.6682E-07	4.9151E-06	7.14E-05	2.855E-06	1.17E-06	4.68E-06	9.36E-05	0.000377
8760-HOUR	1.18E+00	COCHLAN	#VALUE!	2.977E-06	7.326E-06	0.00043	2.33E-06	3.117E-06	2.56E-05	2.14E-05	6.74E-05	3.19E-05	#VALUE!	2.6515E-07	4.8843E-06	7.09E-05	2.838E-06	1.16E-06	4.65E-06	9.3E-05	0.000374
8760-HOUR	7.26E+00	N_RCKP	#VALUE!	1.826E-05	4.494E-05	0.002639	1.43E-05	1.912E-05	0.000157	0.000131	0.000414	0.000195	#VALUE!	1.6264E-06	2.9959E-05	0.000435	1.74E-05	7.13E-06	2.85E-05	0.000571	0.002297
8760-HOUR	7.18E-01	NW_RCKP	#VALUE!	1.806E-06	4.445E-06	0.000261	1.41E-06	1.891E-06	1.55E-05	1.3E-05	4.09E-05	1.93E-05	#VALUE!	1.6086E-07	2.9632E-06	4.3E-05	1.721E-06	7.06E-07	2.82E-06	5.64E-05	0.000227
8760-HOUR	2.98E+00	S_RCKP	#VALUE!	7.488E-06	1.843E-05	0.001082	5.85E-06	7.839E-06	6.43E-05	5.38E-05	0.00017	8.01E-05	#VALUE!	6.6687E-07	1.2284E-05	0.000178	7.137E-06	2.92E-06	1.17E-05	0.000234	0.000942
8760-HOUR	4.10E+00	E_RCKP	#VALUE!	1.032E-05	2.54E-05	0.001492	8.06E-06	1.08E-05	8.87E-05	7.42E-05	0.000234	0.00011	#VALUE!	9.1923E-07	1.6933E-05	0.000246	9.837E-06	4.03E-06	1.61E-05	0.000323	0.001298
8760-HOUR	3.50E+00	W_RCKP	#VALUE!	8.8E-06	2.166E-05	0.001272	6.87E-06	9.212E-06	7.56E-05	6.32E-05	0.000199	9.42E-05	#VALUE!	7.8373E-07	1.4437E-05	0.00021	8.387E-06	3.44E-06	1.37E-05	0.000275	0.001107
8760-HOUR	1.07E+00	WLDNRN_N	#VALUE!	2.696E-06	6.635E-06	0.00039	2.11E-06	2.822E-06	2.32E-05	1.94E-05	6.11E-05	2.89E-05	#VALUE!	2.4012E-07	4.4232E-06	6.42E-05	2.57E-06	1.05E-06	4.21E-06	8.43E-05	0.000339
8760-HOUR	1.56E+00	WLDNRN_S	#VALUE!	3.914E-06	9.632E-06	0.000566	3.06E-06	4.097E-06	3.36E-05	2.81E-05	8.87E-05	4.19E-05	#VALUE!	3.4857E-07	6.421E-06	9.33E-05	3.73E-06	1.53E-06	6.12E-06	0.000122	0.000492
8760-HOUR	1.40E+00	BOB_BNB	#VALUE!	3.521E-06	8.665E-06	0.000509	2.75E-06	3.686E-06	3.03E-05	2.53E-05	7.98E-05	3.77E-05	#VALUE!	3.136E-07	5.7769E-06	8.39E-05	3.356E-06	1.38E-06	5.5E-06	0.00011	0.000443
8760-HOUR	1.60E-01	BLADE_R	#VALUE!	4.026E-07	9.908E-07	5.82E-05	3.15E-07	4.215E-07	3.46E-06	2.89E-06	9.12E-06	3.41E-06	#VALUE!	3.5858E-08	6.6054E-07	9.59E-06	3.837E-07	1.57E-07	6.29E-07	1.26E-05	5.06E-05
8760-HOUR	2.00E+00	LVG_GAP	#VALUE!	5.028E-06	1.237E-05	0.000727	3.93E-06	5.264E-06	4.32E-05	3.61E-05	0.000114	5.38E-05	#VALUE!	4.4782E-07	8.2493E-06	0.00012	4.792E-06	1.96E-06	7.86E-06	0.000157	0.000632
8760-HOUR	3.44E+00	OM_RVR	#VALUE!	8.656E-06	2.13E-05	0.001251	6.76E-06	9.062E-06	7.44E-05	6.22E-05	0.000196	9.27E-05	#VALUE!	7.7096E-07	1.4202E-05	0.000206	8.251E-06	3.38E-06	1.35E-05	0.000271	0.001089
8760-HOUR	3.39E+00	ATRM_EN	#VALUE!	8.532E-06	2.1E-05	0.001233	6.67E-06	8.932E-06	7.33E-05	6.13E-05	0.000193	9.13E-05	#VALUE!	7.5987E-07	1.3998E-05	0.000203	8.132E-06	3.33E-06	1.33E-05	0.000267	0.001073
8760-HOUR	2.22E+00	CBN_RDG	#VALUE!	5.588E-06	1.375E-05	0.000808	4.37E-06	5.85E-06	4.8E-05	4.02E-05	0.000127	5.98E-05	#VALUE!	4.9766E-07	9.1674E-06	0.000133	5.326E-06	2.18E-06	8.73E-06	0.000175	0.000703
8760-HOUR	1.92E+00	CR_HM_EN	#VALUE!	4.833E-06	1.189E-05	0.000699	3.78E-06	5.06E-06	4.15E-05	3.47E-05	0.00011	5.17E-05	#VALUE!	4.3046E-07	7.9295E-06	0.000115	4.607E-06	1.89E-06	7.55E-06	0.000151	0.000608
8760-HOUR	1.74E+00	HNMYNCRK	#VALUE!	4.375E-06	1.077E-05	0.000632	3.42E-06	4.581E-06	3.76E-05	3.14E-05	9.91E-05	4.68E-05	#VALUE!	3.8969E-07	7.1785E-06	0.000104	4.17E-06	1.71E-06	6.84E-06	0.000137	0.00055
8760-HOUR	6.05E+00	BLADE_C	#VALUE!	1.521E-05	3.743E-05	0.002198	1.19E-05	1.592E-05	0.000131	0.000109	0.000345	0.000163	#VALUE!	1.3546E-06	2.4954E-05	0.000362	1.45E-05	5.94E-06	2.38E-05	0.000475	0.001913
8760-HOUR	5.98E+00	MCILY_CRK	#VALUE!	1.504E-05	3.702E-05	0.002174	1.18E-05	1.575E-05	0.000129	0.000108	0.000341	0.000161	#VALUE!	1.3398E-06							

The Pekisko Group
Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies

S50 TSP - Concentration: [ug/m ³]			Deposition to surface soil (mg/kg/year)																		
Average Period	100th Percentile (1st Highest)	Receptor ID																			
Max			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
8760-HOUR	1.80E+03	716	#VALUE!	1.5068E-07	3.7081E-07	2.1778E-05	1.1772E-07	1.5774E-07	1.2949E-06	1.083E-06	3.4138E-06	1.6127E-06	#VALUE!	1.342E-08	2.472E-07	3.5904E-06	1.4361E-07	5.8858E-08	2.3543E-07	4.7087E-06	1.8952E-05
	Sensitive		#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0
8760-HOUR	1.27E-01	CARTWRT	#VALUE!	1.0683E-11	2.6289E-11	1.544E-09	8.3458E-12	1.1183E-11	9.1804E-11	7.6781E-11	2.4203E-10	1.1434E-10	#VALUE!	9.5142E-13	1.7526E-11	2.5455E-10	1.0182E-11	4.1729E-12	1.6692E-11	3.3383E-10	1.3437E-09
8760-HOUR	1.36E+00	CHIMNEY	#VALUE!	1.142E-10	2.8104E-10	1.6505E-08	8.9218E-11	1.1955E-10	9.814E-10	8.208E-10	2.5873E-09	1.2223E-09	#VALUE!	1.0171E-11	1.8736E-10	2.7211E-09	1.0885E-10	4.4609E-11	1.7844E-10	3.5687E-09	1.4364E-08
8760-HOUR	2.16E-01	BB_RANCH	#VALUE!	1.8085E-11	4.4506E-11	2.6138E-09	1.4129E-11	1.8933E-11	1.5542E-10	1.2999E-10	4.0974E-10	1.9357E-10	#VALUE!	1.6107E-12	2.9671E-11	4.3093E-10	1.7237E-11	7.0645E-12	2.8258E-11	5.6516E-10	2.2748E-09
8760-HOUR	2.35E+00	RH_CRK	#VALUE!	1.9688E-10	4.845E-10	2.8455E-08	1.5381E-10	2.061E-10	1.6919E-09	1.415E-09	4.4605E-09	2.1072E-09	#VALUE!	1.7534E-11	3.23E-10	4.6912E-09	1.8765E-10	7.6904E-11	3.0762E-10	6.1523E-09	2.4763E-08
8760-HOUR	1.38E-01	CTRT_CRK	#VALUE!	1.1578E-11	2.8492E-11	1.6734E-09	9.0452E-12	1.2121E-11	9.9497E-11	8.3216E-11	2.6231E-10	1.2392E-10	#VALUE!	1.0312E-12	1.8995E-11	2.7588E-10	1.1035E-11	4.5226E-12	1.809E-11	3.6181E-10	1.4563E-09
8760-HOUR	1.20E+00	OLDM_RF	#VALUE!	1.0088E-10	2.4826E-10	1.458E-08	7.8813E-11	1.0561E-10	8.6695E-10	7.2508E-10	2.2856E-09	1.0797E-09	#VALUE!	8.9847E-12	1.6551E-10	2.4038E-09	9.6152E-11	3.9407E-11	1.5763E-10	3.1525E-09	1.2689E-08
8760-HOUR	9.55E+00	LVST_F	#VALUE!	8.0088E-10	1.9709E-09	1.1575E-07	6.2569E-10	8.3842E-10	6.8826E-09	5.7563E-09	1.8145E-08	8.572E-09	#VALUE!	7.1329E-11	1.3139E-09	1.9084E-08	7.6334E-10	1.2514E-09	2.5028E-08	1.0074E-07	
8760-HOUR	3.14E+00	PLT_MC	#VALUE!	2.6298E-10	6.4718E-10	3.8009E-08	2.0545E-10	2.7531E-10	2.26E-09	1.8902E-09	5.9581E-09	2.8147E-09	#VALUE!	2.3422E-11	4.3145E-10	6.2663E-09	2.5065E-10	1.0273E-10	4.1091E-10	8.2181E-09	3.3078E-08
8760-HOUR	2.16E-01	C_GARDN	#VALUE!	1.808E-11	4.4493E-11	2.6131E-09	1.4125E-11	1.8927E-11	1.5537E-10	1.2995E-10	4.0961E-10	1.9351E-10	#VALUE!	1.6102E-12	2.9662E-11	4.308E-10	1.7232E-11	7.0623E-12	2.849E-11	5.6499E-10	2.2741E-09
8760-HOUR	1.86E-01	S_GARDN	#VALUE!	1.5596E-11	3.8382E-11	2.2542E-09	1.2185E-11	1.6328E-11	1.3403E-10	1.121E-10	3.5336E-10	1.6693E-10	#VALUE!	1.3891E-12	2.5588E-11	3.7163E-10	1.4865E-11	6.0924E-12	2.4369E-11	4.8739E-10	1.9617E-09
8760-HOUR	3.71E-01	RLND_MB	#VALUE!	3.1065E-11	7.645E-11	4.4899E-09	2.427E-11	3.2522E-11	2.6697E-10	2.2328E-10	7.0383E-10	3.325E-10	#VALUE!	2.7668E-12	5.0967E-11	7.4023E-10	2.9609E-11	1.2135E-11	4.854E-11	9.708E-10	3.9075E-09
8760-HOUR	1.03E+00	R_BLAKE	#VALUE!	8.657E-11	2.1304E-10	1.2512E-08	6.7633E-11	9.0628E-11	7.4396E-10	6.2222E-10	1.9614E-09	9.2657E-10	#VALUE!	7.7101E-12	1.4203E-10	2.0628E-09	8.2512E-11	3.3816E-11	1.3527E-10	2.7053E-09	1.0899E-08
8760-HOUR	9.83E-01	B_RANSOM	#VALUE!	8.2427E-11	2.0285E-10	1.1913E-08	6.4396E-11	8.6291E-11	7.0836E-10	5.9244E-10	1.8675E-09	8.8223E-10	#VALUE!	7.3412E-12	1.3523E-10	1.9641E-09	7.8563E-11	3.2198E-11	1.2879E-10	2.5758E-09	1.0368E-08
8760-HOUR	8.42E-01	RCKP_PLC	#VALUE!	7.0585E-11	1.737E-10	1.0202E-08	5.5144E-11	7.3893E-11	6.0659E-10	5.0733E-10	1.5992E-09	7.5548E-10	#VALUE!	6.2864E-12	1.158E-10	1.6819E-09	6.7276E-11	2.7572E-11	1.1029E-10	2.2058E-09	8.8782E-09
8760-HOUR	1.27E+00	S_HARVEY	#VALUE!	1.0624E-10	2.6145E-10	1.5355E-08	8.3E-11	1.1122E-10	9.13E-10	7.636E-10	2.407E-09	1.1371E-09	#VALUE!	9.462E-12	1.743E-10	2.5315E-09	1.0126E-10	4.15E-11	1.66E-10	3.32E-09	1.3363E-08
8760-HOUR	1.13E+00	R_DAVIS	#VALUE!	9.5024E-11	2.3385E-10	1.3734E-08	7.4237E-11	9.9478E-11	8.1661E-10	6.8298E-10	2.1529E-09	1.0171E-09	#VALUE!	8.4631E-12	1.559E-10	2.2642E-09	9.057E-11	3.7119E-11	1.4847E-10	2.9695E-09	1.1952E-08
8760-HOUR	1.19E+00	RESIDEN	#VALUE!	9.9863E-11	2.4576E-10	1.4433E-08	7.8018E-11	1.0454E-10	8.5819E-10	7.1776E-10	2.2625E-09	1.0688E-09	#VALUE!	8.894E-12	1.6384E-10	2.3795E-09	5.9182E-11	3.9009E-11	1.5604E-10	3.1207E-09	1.2561E-08
8760-HOUR	1.18E+00	COCHLAN	#VALUE!	9.9236E-11	2.4421E-10	1.4343E-08	7.7528E-11	1.0389E-10	8.5281E-10	7.1326E-10	2.2483E-09	1.0621E-09	#VALUE!	8.8382E-12	1.6281E-10	2.3646E-09	9.4584E-11	3.8764E-11	1.5506E-10	3.1011E-09	1.2482E-08
8760-HOUR	7.26E+00	N_RCKP	#VALUE!	6.0869E-10	1.498E-09	8.7975E-08	4.7554E-10	6.3723E-10	5.231E-09	4.375E-09	1.3791E-08	6.5149E-09	#VALUE!	5.4212E-11	9.9864E-10	1.4504E-08	5.8016E-10	2.3777E-10	9.5108E-10	1.9022E-08	7.6562E-08
8760-HOUR	7.18E-01	NW_RCKP	#VALUE!	6.0205E-11	1.4816E-10	8.7015E-09	4.7035E-11	6.3027E-11	5.1739E-10	4.3272E-10	1.364E-09	6.4438E-10	#VALUE!	5.362E-12	9.8774E-11	1.4346E-09	5.7383E-11	2.3518E-11	9.407E-11	1.8814E-09	5.7272E-09
8760-HOUR	2.98E+00	S_RCKP	#VALUE!	2.4959E-10	6.1422E-10	3.6073E-08	1.9499E-10	2.6129E-10	2.1449E-09	1.7939E-09	5.6547E-09	2.6714E-09	#VALUE!	2.2229E-11	4.0948E-10	5.9472E-09	3.2789E-10	9.7495E-11	3.8998E-10	7.7996E-09	3.1394E-08
8760-HOUR	4.10E+00	E_RCKP	#VALUE!	3.4404E-10	8.4666E-10	4.9724E-08	2.6878E-10	3.6016E-10	2.9566E-09	2.4728E-09	7.7946E-09	3.6823E-09	#VALUE!	3.0641E-11	5.6444E-10	8.1978E-09	3.2791E-10	1.3439E-10	5.3756E-10	1.0751E-08	4.3274E-08
8760-HOUR	3.50E+00	W_RCKP	#VALUE!	2.9332E-10	7.2185E-10	4.2394E-08	2.2916E-10	3.0707E-10	2.5208E-09	2.1083E-09	6.6456E-09	3.1395E-09	#VALUE!	2.6124E-11	4.8123E-10	6.9894E-09	2.7957E-10	1.1458E-10	4.5832E-10	9.1664E-09	3.6895E-08
8760-HOUR	1.07E+00	WLDNRN_N	#VALUE!	8.9869E-11	2.2116E-10	1.2989E-08	7.021E-11	9.4081E-11	7.7231E-10	6.4593E-10	2.0361E-09	9.6187E-10	#VALUE!	8.0039E-12	1.4744E-10	2.1414E-09	8.5656E-11	3.5105E-11	1.4042E-10	2.8084E-09	1.304E-08
8760-HOUR	1.56E+00	WLDNRN_S	#VALUE!	1.3046E-10	3.2105E-10	1.8855E-08	1.0192E-10	1.3657E-10	1.1211E-09	9.3767E-10	2.9557E-09	1.3963E-09	#VALUE!	1.1619E-11	2.1403E-10	3.1086E-09	1.2434E-10	5.096E-11	2.0384E-10	4.0768E-09	1.6409E-08
8760-HOUR	1.40E+00	BOB_BNB	#VALUE!	1.1737E-10	2.8884E-10	1.6964E-08	9.1697E-11	1.2287E-10	1.0087E-09	8.4361E-10	2.6592E-09	1.2562E-09	#VALUE!	1.0453E-11	1.9256E-10	2.7967E-09	1.1187E-10	4.5848E-11	1.8339E-10	3.6679E-09	1.4763E-08
8760-HOUR	1.60E-01	BLADE_R	#VALUE!	1.3421E-11	3.3027E-11	1.9397E-09	1.0485E-11	1.405E-11	1.1533E-10	9.646E-11	3.0406E-10	1.4364E-10	#VALUE!	1.1953E-12	2.2018E-11	3.1979E-10	1.2791E-11	5.2424E-12	2.097E-11	4.1939E-10	1.6881E-09
8760-HOUR	2.00E+00	LVG_GAP	#VALUE!	1.6761E-10	4.1247E-10	2.4224E-08	1.3094E-10	1.7546E-10	1.4404E-09	1.2047E-09	3.7973E-09	1.7939E-09	#VALUE!	1.4927E-11	2.7498E-10	3.9937E-09	1.5975E-10	6.5471E-11	2.6188E-10	5.2377E-09	2.1082E-08
8760-HOUR	3.44E+00	OM_RVR	#VALUE!	2.8855E-10	7.1009E-10	4.1704E-08	2.2543E-10	3.0207E-10	2.4797E-09	2.0739E-09	6.5374E-09	3.0883E-09	#VALUE!	2.5699E-11	4.734E-10	6.8755E-09	2.7502E-10	1.1271E-10	4.5085E-10	9.0171E-09	3.6294E-08
8760-HOUR	3.39E+00	ATRM_EN	#VALUE!	2.844E-10	6.9988E-10	4.1104E-08	2.2218E-10	2.9773E-10	2.444E-09	2.0441E-09	6.4434E-09	3.0439E-09	#VALUE!	2.5329E-11	4.6659E-10	6.7766E-09	2.7107E-10	1.1109E-10	4.4437E-10	8.8874E-09	3.5772E-08
8760-HOUR	2.22E+00	CBN_RDG	#VALUE!	1.8626E-10	4.5837E-10	2.692E-08	1.4551E-10	1.9499E-10	1.6007E-09	1.3387E-09	4.2199E-09	1.9936E-09	#VALUE!	1.6589E-11	3.0558E-10	4.4382E-09	1.7753E-10	7.2757E-11	2.9103E-10	5.8206E-09	2.3428E-08
8760-HOUR	1.92E+00	CR_HM_EN	#VALUE!	1.6111E-10	3.9647E-10	2.3285E-08	1.2586E-10	1.6866E-10	1.3845E-09	1.158E-09	3.6501E-09	1.7243E-09	#VALUE!	1.4349E-11							

The Pekisko Group
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S50 TSP - Concentration: [ug/m**3]			Concentration in Surface Soil (mg/kg)																		
Average Period	100th Percentile (1st Highest)	Receptor ID																			
Max			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenu m	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
8760-HOUR	1.80E+03	716	#VALUE!	0.29200276	0.71860054	42.203524	0.22812716	0.30569039	2.50939872	2.09876984	6.61568754	3.12534205	#VALUE!	0.0260065	0.47906703	6.95787828	0.27831513	0.11406358	0.45625431	9.12508627	36.7284722
	Sensitive		#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0
8760-HOUR	1.27E-01	CARTWRT	#VALUE!	2.0702E-05	5.0947E-05	0.00299212	1.6174E-05	2.1673E-05	0.00017791	0.0001488	0.00046904	0.00022158	#VALUE!	1.8438E-06	3.3965E-05	0.0004933	1.9732E-05	0.0868E-06	3.2347E-05	0.00064695	0.00260396
8760-HOUR	1.36E+00	CHIMNEY	#VALUE!	0.00022131	0.00054463	0.03198619	0.0001729	0.00023168	0.00190188	0.00159066	0.00501405	0.00236871	#VALUE!	1.971E-05	0.00036309	0.0052734	0.00021094	8.6449E-05	0.0003458	0.00691593	0.02783663
8760-HOUR	2.16E-01	BB_RANCH	#VALUE!	3.5048E-05	8.625E-05	0.00506547	2.7381E-05	3.669E-05	0.00030119	0.0002519	0.000079405	0.00037512	#VALUE!	3.1214E-06	5.75E-05	0.00083512	3.3405E-05	1.369E-05	0.00109524	0.00400833	
8760-HOUR	2.35E+00	RH_CRK	#VALUE!	0.00038153	0.00093893	0.05514321	0.00029807	0.00039942	0.00327879	0.00274226	0.00864407	0.00408358	#VALUE!	3.398E-05	0.00062595	0.00909118	0.00036365	0.00014904	0.00059614	0.01192286	0.0479895
8760-HOUR	1.38E-01	CTRT_CRK	#VALUE!	2.2437E-05	5.5217E-05	0.00324288	1.7529E-05	2.3489E-05	0.00019282	0.00016127	0.00050834	0.00024015	#VALUE!	1.9983E-06	3.8811E-05	0.00053464	2.1385E-05	8.7645E-06	3.5058E-05	0.00070116	0.00282218
8760-HOUR	1.20E+00	OLDM_RF	#VALUE!	0.0001955	0.00048112	0.02825601	0.00015274	0.00020467	0.00168009	0.00140516	0.00442932	0.00209247	#VALUE!	1.7412E-05	0.00032074	0.00465842	0.00018634	7.6368E-05	0.00030547	0.00610941	0.02459037
8760-HOUR	9.55E+00	LVST_F	#VALUE!	0.00155206	0.00381952	0.22432123	0.00121255	0.00162481	0.01333802	0.01115543	0.03516387	0.0166119	#VALUE!	0.00013823	0.00254635	0.03698269	0.00147931	0.00060627	0.00242509	0.04850189	0.1952201
8760-HOUR	3.14E+00	PLT_MC	#VALUE!	0.00050964	0.00125419	0.07365851	0.00039815	0.00053353	0.00437969	0.00366302	0.01154647	0.00545471	#VALUE!	4.539E-05	0.00083612	0.0121437	0.00048575	0.00019908	0.00079631	0.01592616	0.06410281
8760-HOUR	2.16E-01	C_GARDN	#VALUE!	3.5037E-05	8.6224E-05	0.00506394	2.7373E-05	3.6679E-05	0.0003011	0.00025183	0.00079381	0.00037501	#VALUE!	3.1205E-06	5.7483E-05	0.00083487	3.3395E-05	1.3686E-05	5.4745E-05	0.00109491	0.004407
8760-HOUR	1.86E-01	S_GARDN	#VALUE!	3.0225E-05	7.4382E-05	0.00436844	2.3613E-05	3.1642E-05	0.00025975	0.00021724	0.00068478	0.0003235	#VALUE!	2.6919E-06	4.9588E-05	0.0007202	2.8808E-05	1.1807E-05	4.7226E-05	0.00094453	0.00380173
8760-HOUR	3.71E-01	RLND_MB	#VALUE!	6.0203E-05	0.00014816	0.0080712	4.7034E-05	6.3025E-05	0.00051737	0.00043271	0.00136397	0.00064436	#VALUE!	5.3618E-06	9.877E-05	0.00143452	5.7381E-05	2.3517E-05	9.4067E-05	0.00188134	0.0075724
8760-HOUR	1.03E+00	R_BLAKE	#VALUE!	0.00016777	0.00041286	0.02424761	0.00013107	0.00017563	0.00144175	0.00120583	0.00380098	0.00179563	#VALUE!	1.4942E-05	0.00027524	0.00399758	0.0001599	6.5534E-05	0.00026214	0.00524273	0.01210198
8760-HOUR	9.83E-01	B_RANSOM	#VALUE!	0.00015974	0.00039311	0.02308718	0.0001248	0.00016723	0.00137275	0.00114812	0.00361907	0.0017097	#VALUE!	1.4227E-05	0.00026207	0.00380626	0.00015225	6.2398E-05	0.00024959	0.00499182	0.02009208
8760-HOUR	8.42E-01	RCKP_PL	#VALUE!	0.00013679	0.00033663	0.01977023	0.00010687	0.00014132	0.00117553	0.00098317	0.00309912	0.00146407	#VALUE!	1.2183E-05	0.00022442	0.00325942	0.00013038	5.3433E-05	0.00021373	0.00427464	0.01720544
8760-HOUR	1.27E+00	S_HARVEY	#VALUE!	0.00020589	0.00050667	0.02975689	0.00016085	0.00021554	0.00176933	0.0014798	0.00466459	0.00220362	#VALUE!	1.8337E-05	0.00033778	0.00490586	0.00019623	8.0424E-05	0.0003217	0.00643392	0.02589653
8760-HOUR	1.13E+00	R_DAVIS	#VALUE!	0.00018415	0.00045318	0.02661544	0.00014387	0.00019278	0.00158254	0.00132358	0.00417215	0.00197098	#VALUE!	1.6401E-05	0.00030212	0.00438795	0.00017552	7.1934E-05	0.00028773	0.00575469	0.02316262
8760-HOUR	1.19E+00	RESIDEN	#VALUE!	0.00019353	0.00047626	0.02797074	0.00015119	0.0002026	0.00166313	0.00139098	0.0043846	0.00207135	#VALUE!	1.7236E-05	0.00031751	0.000461139	0.00018446	7.5597E-05	0.00030239	0.00604773	0.02434211
8760-HOUR	1.18E+00	COCHLAN	#VALUE!	0.00019231	0.00047327	0.02779524	0.00015024	0.00020133	0.00165269	0.00138225	0.00435709	0.00205835	#VALUE!	1.7128E-05	0.00031551	0.00458246	0.0001833	7.5122E-05	0.00030049	0.00600978	0.02418937
8760-HOUR	7.26E+00	N_RCKP	#VALUE!	0.00117961	0.00290295	0.17049047	0.00092157	0.0012349	0.01013727	0.00847845	0.02672553	0.01262551	#VALUE!	0.00010506	0.0019353	0.02810789	0.00112432	0.00046079	0.00184314	0.03686281	0.14837279
8760-HOUR	7.18E-01	NW_RCKP	#VALUE!	0.00011667	0.00028713	0.01686298	9.1151E-05	0.00012214	0.00100266	0.00083859	0.00264339	0.00124877	#VALUE!	1.0391E-05	0.00019142	0.00278011	0.0001112	4.5576E-05	0.0001823	0.00364605	0.01467535
8760-HOUR	2.98E+00	S_RCKP	#VALUE!	0.00048369	0.00119032	0.06990779	0.00037788	0.00050636	0.00415668	0.0034765	0.01095852	0.00517695	#VALUE!	4.3078E-05	0.00079355	0.01152534	0.00046101	0.00018894	0.00075576	0.0151152	0.06083867
8760-HOUR	4.10E+00	E_RCKP	#VALUE!	0.00066672	0.00164077	0.09636239	0.00052088	0.00069798	0.00572966	0.00479208	0.01510546	0.00713603	#VALUE!	5.938E-05	0.00109384	0.01588677	0.00063547	0.00026044	0.00104176	0.02083511	0.08386133
8760-HOUR	3.50E+00	W_RCKP	#VALUE!	0.00056844	0.0013989	0.08215779	0.0004441	0.00059509	0.00488506	0.00408568	0.01287879	0.00608412	#VALUE!	5.0627E-05	0.0009326	0.01354493	0.0005418	0.00022205	0.00088819	0.01776385	0.07149948
8760-HOUR	1.07E+00	WLDNR_N	#VALUE!	0.00017416	0.0004286	0.0251715	0.00013606	0.00018232	0.00149668	0.00125177	0.0039458	0.00186405	#VALUE!	1.5511E-05	0.00028573	0.0041499	0.000166	6.8031E-05	0.00027212	0.00544249	0.02190601
8760-HOUR	1.56E+00	WLDNR_S	#VALUE!	0.00025282	0.00062218	0.03654047	0.00019752	0.00026467	0.00217268	0.00181715	0.00572796	0.00270597	#VALUE!	2.2517E-05	0.00041478	0.00602424	0.00024097	9.8758E-05	0.00039503	0.00790064	0.03180008
8760-HOUR	1.40E+00	BOB_BNB	#VALUE!	0.00022746	0.00055976	0.03287486	0.0001777	0.00023812	0.00195472	0.00163486	0.00515336	0.00243452	#VALUE!	2.0258E-05	0.00037317	0.00541991	0.0002168	8.8851E-05	0.0003554	0.00710808	0.02861001
8760-HOUR	1.60E-01	BLADE_R	#VALUE!	2.6008E-05	6.4005E-05	0.003759	2.0319E-05	2.7227E-05	0.00022351	0.00018693	0.00058925	0.00027837	#VALUE!	2.3164E-06	4.267E-05	0.00061973	2.4789E-05	1.0159E-05	4.0638E-05	0.00081276	0.00327134
8760-HOUR	2.00E+00	LVG_GAP	#VALUE!	0.00032481	0.00079933	0.04694504	0.00025376	0.00034003	0.00279133	0.00233456	0.00735895	0.00347647	#VALUE!	2.8928E-05	0.00053289	0.00773959	0.00030958	0.00012688	0.00050751	0.01015028	0.04085488
8760-HOUR	3.44E+00	OM_RVR	#VALUE!	0.00055918	0.00137612	0.0808195	0.00043686	0.0005854	0.00480548	0.00401913	0.012166	0.00598501	#VALUE!	4.9802E-05	0.00091741	0.0133243	0.00053297	0.00021843	0.00087372	0.01747409	0.07033481
8760-HOUR	3.39E+00	ATRM_EN	#VALUE!	0.00055114	0.00135633	0.07965731	0.00043058	0.00057698	0.00473638	0.00396134	0.01248682	0.00589895	#VALUE!	4.9086E-05	0.00090422	0.01313269	0.00052531	0.00021529	0.00086116	0.0172232	0.06932339
8760-HOUR	2.22E+00	CBN_RDG	#VALUE!	0.00036096	0.00088829	0.05216964	0.000282	0.00037788	0.00301098	0.00259438	0.00817794	0.00386337	#VALUE!	3.2148E-05	0.0005922	0.00860094	0.00034404	0.000141	0.000564	0.01127992	0.04540169
8760-HOUR	1.92E+00	CR_HM_EN	#VALUE!	0.00031222	0.00076834	0.04512486	0.00024392	0.00032685	0.0026831	0.00224405	0.00707363	0.00334168	#VALUE!	2.7807E-05	0.00051223						

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SO TSP - Concentration: [ug/m**3]			Dry deposition (ug/m2/s)																		
Average Period	100th Percentile (1st Highest)	Receptor ID	n/a	1.28E-06	3.15E-06	1.85E-04	1.00E-06	1.34E-06	1.10E-05	9.20E-06	2.90E-05	1.37E-05	n/a	1.14E-07	2.10E-06	3.05E-05	1.22E-06	5.00E-07	2.00E-06	4.00E-05	1.61E-04
MPOI			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
8760-HOUR	3.60E+03	716	#VALUE!	4.602E-05	0.0001132	0.006651	3.6E-05	4.817E-05	0.000395	0.000331	0.001043	0.000493	#VALUE!	4.0984E-06	7.5496E-05	0.001096	4.386E-05	1.8E-05	7.19E-05	0.001438	0.005788
Sensitive			#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0
8760-HOUR	2.55E-01	CARTWRT	#VALUE!	3.262E-09	8.029E-09	4.72E-07	2.55E-09	3.415E-09	2.8E-08	2.34E-08	7.39E-08	3.49E-08	#VALUE!	2.9056E-10	5.3525E-09	7.77E-08	3.11E-09	1.27E-09	5.1E-09	1.02E-07	4.1E-07
8760-HOUR	2.72E+00	CHIMNEY	#VALUE!	3.488E-08	8.583E-08	5.04E-06	2.72E-08	3.651E-08	3E-07	2.51E-07	7.9E-07	3.73E-07	#VALUE!	3.1062E-09	5.7219E-08	8.31E-07	3.324E-08	1.36E-08	5.45E-08	1.09E-06	4.39E-06
8760-HOUR	4.31E-01	BB_RANCH	#VALUE!	5.523E-09	1.359E-08	7.98E-07	4.31E-09	5.782E-09	4.75E-08	3.97E-08	1.25E-07	5.91E-08	#VALUE!	4.919E-10	9.0614E-09	1.32E-07	5.264E-09	2.16E-09	8.63E-09	1.73E-07	6.95E-07
8760-HOUR	4.70E+00	RH_CRK	#VALUE!	6.013E-08	1.48E-07	8.69E-06	4.7E-08	6.294E-08	5.17E-07	4.32E-07	1.36E-06	6.44E-07	#VALUE!	5.3549E-09	9.8643E-08	1.43E-06	5.731E-08	2.35E-08	9.39E-08	1.88E-06	7.56E-06
8760-HOUR	2.76E-01	CTRT_CRK	#VALUE!	3.536E-09	8.702E-09	5.11E-07	2.76E-09	3.702E-09	3.04E-08	2.54E-08	8.01E-08	3.78E-08	#VALUE!	3.1491E-10	5.801E-09	8.43E-08	3.37E-09	1.38E-09	5.52E-09	1.1E-07	4.45E-07
8760-HOUR	2.41E+00	OLDM_RF	#VALUE!	3.081E-08	7.582E-08	4.45E-06	2.41E-08	3.225E-08	2.65E-07	2.21E-07	6.98E-07	3.3E-07	#VALUE!	2.7439E-09	5.0546E-08	7.34E-07	2.936E-08	1.2E-08	4.81E-08	9.63E-07	3.88E-06
8760-HOUR	1.91E+01	LVST_F	#VALUE!	2.446E-07	6.019E-07	3.54E-05	1.91E-07	2.561E-07	2.1E-06	1.76E-06	5.54E-06	2.62E-06	#VALUE!	2.1784E-08	4.0128E-07	5.83E-06	2.331E-07	9.55E-08	3.82E-07	7.64E-06	3.08E-05
8760-HOUR	6.27E+00	PLT_MC	#VALUE!	8.031E-08	1.976E-07	1.16E-05	6.27E-08	8.408E-08	6.9E-07	5.77E-07	1.82E-06	8.6E-07	#VALUE!	7.1529E-09	1.3176E-07	1.91E-06	7.655E-08	3.14E-08	1.25E-07	2.51E-06	1.01E-05
8760-HOUR	4.31E-01	C_GARDN	#VALUE!	5.521E-09	1.359E-08	7.98E-07	4.31E-09	5.78E-09	4.75E-08	3.97E-08	1.25E-07	5.91E-08	#VALUE!	4.9176E-10	9.0587E-09	1.32E-07	5.263E-09	2.16E-09	8.63E-09	1.73E-07	6.94E-07
8760-HOUR	3.72E-01	S_GARDN	#VALUE!	4.763E-09	1.172E-08	6.88E-07	3.72E-09	4.986E-09	4.09E-08	3.42E-08	1.08E-07	5.1E-08	#VALUE!	4.2422E-10	7.8145E-09	1.13E-07	4.54E-09	1.86E-09	7.44E-09	1.49E-07	5.99E-07
8760-HOUR	7.41E-01	RLND_MB	#VALUE!	9.487E-09	2.335E-08	1.37E-06	7.41E-09	9.932E-09	8.15E-08	6.82E-08	2.15E-07	1.02E-07	#VALUE!	8.4497E-10	1.5565E-08	2.26E-07	9.043E-09	3.71E-09	1.48E-08	2.96E-07	1.19E-06
8760-HOUR	2.07E+00	R_BLAKE	#VALUE!	2.644E-08	6.506E-08	3.82E-06	2.07E-08	2.768E-08	2.27E-07	1.9E-07	5.99E-07	2.83E-07	#VALUE!	2.3547E-09	4.3376E-08	6.3E-07	2.52E-08	1.03E-08	4.13E-08	8.26E-07	3.33E-06
8760-HOUR	1.97E+00	B_RANSOM	#VALUE!	2.517E-08	6.195E-08	3.64E-06	1.97E-08	2.635E-08	2.16E-07	1.81E-07	5.7E-07	2.69E-07	#VALUE!	2.242E-09	4.13E-08	6E-07	2.399E-08	9.83E-09	3.93E-08	7.87E-07	3.17E-06
8760-HOUR	1.68E+00	RCKP_PLC	#VALUE!	2.156E-08	5.305E-08	3.12E-06	1.68E-08	2.257E-08	1.85E-07	1.55E-07	4.88E-07	2.31E-07	#VALUE!	1.9199E-09	3.5366E-08	5.14E-07	2.055E-08	8.42E-09	3.37E-08	6.74E-07	2.71E-06
8760-HOUR	2.53E+00	S_HARVEY	#VALUE!	3.245E-08	7.985E-08	4.69E-06	2.53E-08	3.397E-08	2.79E-07	2.33E-07	7.35E-07	3.47E-07	#VALUE!	2.8897E-09	5.3231E-08	7.73E-07	3.092E-08	1.27E-08	5.07E-08	1.01E-06	4.08E-06
8760-HOUR	2.27E+00	R_DAVIS	#VALUE!	2.902E-08	7.142E-08	4.19E-06	2.27E-08	3.038E-08	2.49E-07	2.09E-07	6.57E-07	3.11E-07	#VALUE!	2.5846E-09	4.7611E-08	6.91E-07	2.766E-08	1.13E-08	4.53E-08	9.07E-07	3.65E-06
8760-HOUR	2.38E+00	RESIDEN	#VALUE!	3.05E-08	7.505E-08	4.41E-06	2.38E-08	3.193E-08	2.62E-07	2.19E-07	6.91E-07	3.26E-07	#VALUE!	2.7162E-09	5.0036E-08	7.27E-07	2.907E-08	1.19E-08	4.77E-08	9.53E-07	3.84E-06
8760-HOUR	2.37E+00	COCHLAN	#VALUE!	3.031E-08	7.458E-08	4.38E-06	2.37E-08	3.173E-08	2.6E-07	2.18E-07	6.87E-07	3.24E-07	#VALUE!	2.6992E-09	4.9722E-08	7.22E-07	2.889E-08	1.18E-08	4.74E-08	9.47E-07	3.81E-06
8760-HOUR	1.45E+01	N_RCKP	#VALUE!	1.859E-07	4.575E-07	2.69E-05	1.45E-07	1.946E-07	1.6E-06	1.34E-06	4.21E-06	1.99E-06	#VALUE!	1.6556E-08	3.0498E-07	4.43E-06	1.772E-07	7.26E-08	2.9E-07	5.81E-06	2.34E-05
8760-HOUR	1.44E+00	NW_RCKP	#VALUE!	1.839E-08	4.525E-08	2.66E-06	1.44E-08	1.925E-08	1.58E-07	1.32E-07	4.17E-07	1.97E-07	#VALUE!	1.6376E-09	3.0165E-08	4.38E-07	1.752E-08	7.18E-09	2.87E-08	5.75E-07	2.31E-06
8760-HOUR	5.96E+00	S_RCKP	#VALUE!	7.622E-08	1.876E-07	1.1E-05	5.96E-08	7.98E-08	6.55E-07	5.48E-07	1.73E-06	8.16E-07	#VALUE!	6.7887E-09	1.2506E-07	1.82E-06	7.265E-08	2.98E-08	1.19E-07	2.38E-06	9.59E-06
8760-HOUR	8.21E+00	E_RCKP	#VALUE!	1.051E-07	2.586E-07	1.52E-05	8.21E-08	1.1E-07	9.03E-07	7.55E-07	2.38E-06	1.12E-06	#VALUE!	9.3577E-09	1.7238E-07	2.5E-06	1.001E-07	4.1E-08	1.64E-07	3.28E-06	1.32E-05
8760-HOUR	7.00E+00	W_RCKP	#VALUE!	8.958E-08	2.205E-07	1.29E-05	7E-08	9.378E-08	7.7E-07	6.44E-07	2.03E-06	9.59E-07	#VALUE!	7.9783E-09	1.4697E-07	2.13E-06	8.538E-08	3.5E-08	1.4E-07	2.8E-06	1.13E-05
8760-HOUR	2.14E+00	WLDNR_N	#VALUE!	2.745E-08	6.754E-08	3.97E-06	2.14E-08	2.873E-08	2.36E-07	1.97E-07	6.22E-07	2.94E-07	#VALUE!	2.4444E-09	4.5028E-08	6.54E-07	2.616E-08	1.07E-08	4.29E-08	8.58E-07	3.45E-06
8760-HOUR	3.11E+00	WLDNR_S	#VALUE!	3.984E-08	9.805E-08	5.76E-06	3.11E-08	4.171E-08	3.42E-07	2.86E-07	9.03E-07	4.26E-07	#VALUE!	3.5484E-09	6.5366E-08	9.49E-07	3.797E-08	1.56E-08	6.23E-08	1.25E-06	5.01E-06
8760-HOUR	2.80E+00	BOB_BNB	#VALUE!	3.585E-08	8.821E-08	5.18E-06	2.8E-08	3.753E-08	3.08E-07	2.58E-07	8.12E-07	3.84E-07	#VALUE!	3.1925E-09	5.8808E-08	8.54E-07	3.416E-08	1.4E-08	5.6E-08	1.12E-06	4.51E-06
8760-HOUR	3.20E-01	BLADE_R	#VALUE!	4.099E-09	1.009E-08	5.92E-07	3.2E-09	4.291E-09	3.52E-08	2.95E-08	9.29E-08	4.39E-08	#VALUE!	3.6503E-10	6.7243E-09	9.77E-08	3.907E-09	1.6E-09	6.4E-09	1.28E-07	5.16E-07
8760-HOUR	4.00E+00	LVG_GAP	#VALUE!	5.119E-08	1.26E-07	7.4E-06	4E-08	5.359E-08	4.4E-07	3.68E-07	1.16E-06	5.48E-07	#VALUE!	4.5588E-09	8.3978E-08	1.22E-06	4.879E-08	2E-08	8E-08	1.6E-06	6.44E-06
8760-HOUR	6.88E+00	OM_RVR	#VALUE!	8.812E-08	2.169E-07	1.27E-05	6.88E-08	9.225E-08	7.57E-07	6.33E-07	2E-06	9.43E-07	#VALUE!	7.8483E-09	1.4457E-07	2.1E-06	8.399E-08	3.44E-08	1.38E-07	2.75E-06	1.11E-05
8760-HOUR	6.79E+00	ATRM_EN	#VALUE!	8.685E-08	2.137E-07	1.26E-05	6.79E-08	9.093E-08	7.46E-07	6.24E-07	1.97E-06	9.3E-07	#VALUE!	7.7355E-09	1.425E-07	2.07E-06	8.278E-08	3.39E-08	1.36E-07	2.71E-06	1.09E-05
8760-HOUR	4.44E+00	CBN_RDG	#VALUE!	5.688E-08	1.4E-07	8.22E-06	4.44E-08	5.955E-08	4.89E-07	4.09E-07	1.29E-06	6.09E-07	#VALUE!	5.0662E-09	9.3324E-08	1.36E-06	5.422E-08	2.22E-08	8.89E-08	1.78E-06	7.15E-06
8760-HOUR	3.84E+00	CR_HM_EN	#VALUE!	4.92E-08	1.211E-07	7.11E-06	3.84E-08	5.151E-08	4.23E-07	3.54E-07	1.11E-06	5.27E-07	#VALUE!	4.382E-09	8.0722E-08	1.17E-06	4.69E-08	1.92E-08	7.69E-08	1.54E-06	6.19E-06
8760-HOUR	3.48E+00	HNYMNCRK	#VALUE!	4.454E-08	1.096E-07	6.44E-06	3.48E-08	4.663E-08	3.83E-07	3.2E-07	1.01E-06	4.77E-07	#VALUE!	3.967E-09	7.3077E-08	1.06E-06	4.245E-08	1.74E-08	6.96E-08	1.39E-06	5.6E-06
8760-HOUR	1.21E+01	BLADE_C	#VALUE!	1.548E-07	3.81E-07	2.24E-05	1.21E-07	1.621E-07	1.33E-06	1.11E-06	3.51E-06	1.67E-06	#VALUE!	1.379E-08	2.5403E-07	3.69E-06	1.476E-07	6.05E-08	2.42E-07	4.84E-06	1.95E-05
8760-HOUR	1.20E+01	MCLY_CRK	#VALUE!	1.531E-07	3.769E-07	2.21E-05	1.2E-07	1.603E-07	1.3												

The Pekisko Group
Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies

SO TSP - Concentration: [ug/m**3]			Wet deposition (ug/m2/s)																		
Average Period	100th Percentile (1st Highest)	Receptor ID	n/a	1.28E-06	3.15E-06	1.85E-04	1.00E-06	1.34E-06	1.10E-05	9.20E-06	2.90E-05	1.37E-05	n/a	1.14E-07	2.10E-06	3.05E-05	1.22E-06	5.00E-07	2.00E-06	4.00E-05	1.61E-04
MPOI			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
8760-HOUR	3.60E+03	716	#VALUE!	2.852E-10	7.019E-10	4.12E-08	2.23E-10	2.986E-10	2.45E-09	2.05E-09	6.46E-09	3.05E-09	#VALUE!	2.5402E-11	4.6793E-10	6.8E-09	2.718E-10	1.11E-10	4.46E-10	8.91E-09	3.59E-08
Sensitive			#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0
8760-HOUR	2.55E-01	CARTWRT	#VALUE!	2.022E-14	4.976E-14	2.92E-12	1.58E-14	2.117E-14	1.74E-13	1.45E-13	4.58E-13	2.16E-13	#VALUE!	1.801E-15	3.3175E-14	4.82E-13	1.927E-14	7.9E-15	3.16E-14	6.32E-13	2.54E-12
8760-HOUR	2.72E+00	CHIMNEY	#VALUE!	2.162E-13	5.32E-13	3.12E-11	1.69E-13	2.263E-13	1.86E-12	1.55E-12	4.9E-12	2.31E-12	#VALUE!	1.9252E-14	3.5465E-13	5.15E-12	2.06E-13	8.44E-14	3.38E-13	6.76E-12	2.72E-11
8760-HOUR	4.31E-01	BB_RANCH	#VALUE!	3.423E-14	8.425E-14	4.95E-12	2.67E-14	3.584E-14	2.94E-13	2.46E-13	7.76E-13	3.66E-13	#VALUE!	3.0489E-15	5.6164E-14	8.16E-13	3.263E-14	1.34E-14	5.35E-14	1.07E-12	4.31E-12
8760-HOUR	4.70E+00	RH_CRK	#VALUE!	3.727E-13	9.171E-13	5.39E-11	2.91E-13	3.901E-13	3.2E-12	2.68E-12	8.44E-12	3.99E-12	#VALUE!	3.3191E-14	6.114E-13	8.88E-12	3.552E-13	1.46E-13	5.82E-13	1.16E-11	4.69E-11
8760-HOUR	2.76E-01	CTRT_CRK	#VALUE!	2.192E-14	5.393E-14	3.17E-12	1.71E-14	2.294E-14	1.88E-13	1.58E-13	4.97E-13	2.35E-13	#VALUE!	1.9519E-15	3.5956E-14	5.22E-13	2.089E-14	8.56E-15	3.42E-14	6.85E-13	2.76E-12
8760-HOUR	2.41E+00	OLDM_RF	#VALUE!	1.91E-13	4.699E-13	2.76E-11	1.49E-13	1.999E-13	1.64E-12	1.37E-12	4.33E-12	2.04E-12	#VALUE!	1.7007E-14	3.1329E-13	4.55E-12	1.82E-13	7.46E-14	2.98E-13	5.97E-12	2.4E-11
8760-HOUR	1.91E+01	LVST_F	#VALUE!	1.516E-12	3.731E-12	2.19E-10	1.18E-12	1.587E-12	1.3E-11	1.09E-11	3.43E-11	1.62E-11	#VALUE!	1.3502E-13	2.4872E-12	3.61E-11	1.445E-12	5.92E-13	2.37E-12	4.74E-11	1.91E-10
8760-HOUR	6.27E+00	PLT_MC	#VALUE!	4.978E-13	1.225E-12	7.19E-11	3.89E-13	5.211E-13	4.28E-12	3.58E-12	1.13E-11	5.33E-12	#VALUE!	4.4335E-14	8.1669E-13	1.19E-11	4.745E-13	1.94E-13	7.78E-13	1.56E-11	6.26E-11
8760-HOUR	4.31E-01	C_GARDN	#VALUE!	3.422E-14	8.422E-14	4.95E-12	2.67E-14	3.583E-14	2.94E-13	2.46E-13	7.75E-13	3.66E-13	#VALUE!	3.048E-15	5.6147E-14	8.15E-13	3.262E-14	1.34E-14	5.35E-14	1.07E-12	4.3E-12
8760-HOUR	3.72E-01	S_GARDN	#VALUE!	2.952E-14	7.265E-14	4.27E-12	2.31E-14	3.091E-14	2.54E-13	2.12E-13	6.69E-13	3.16E-13	#VALUE!	2.6294E-15	4.8435E-14	7.03E-13	2.814E-14	1.15E-14	4.61E-14	9.23E-13	3.71E-12
8760-HOUR	7.41E-01	RLND_MB	#VALUE!	5.88E-14	1.447E-13	8.5E-12	4.59E-14	6.156E-14	5.05E-13	4.23E-13	1.33E-12	6.29E-13	#VALUE!	5.2372E-15	9.6475E-14	1.4E-12	5.605E-14	2.3E-14	9.19E-14	1.84E-12	7.4E-12
8760-HOUR	2.07E+00	R_BLAKE	#VALUE!	1.639E-13	4.033E-13	2.37E-11	1.28E-13	1.716E-13	1.41E-12	1.18E-12	3.71E-12	1.75E-12	#VALUE!	1.4595E-14	2.6885E-13	3.9E-12	1.562E-13	6.4E-14	2.56E-13	5.12E-12	2.06E-11
8760-HOUR	1.97E+00	B_RANSOM	#VALUE!	1.56E-13	3.84E-13	2.26E-11	1.22E-13	1.633E-13	1.34E-12	1.12E-12	3.53E-12	1.67E-12	#VALUE!	1.3896E-14	2.5598E-13	3.72E-12	1.487E-13	6.09E-14	2.44E-13	4.88E-12	1.96E-11
8760-HOUR	1.68E+00	RCKP_PLC	#VALUE!	1.336E-13	3.288E-13	1.93E-11	1.04E-13	1.399E-13	1.15E-12	9.6E-13	3.03E-12	1.43E-12	#VALUE!	1.19E-14	2.192E-13	3.18E-12	1.273E-13	5.22E-14	2.09E-13	4.18E-12	1.68E-11
8760-HOUR	2.53E+00	S_HARVEY	#VALUE!	2.011E-13	4.949E-13	2.91E-11	1.57E-13	2.105E-13	1.73E-12	1.45E-12	4.56E-12	2.15E-12	#VALUE!	1.7911E-14	3.2993E-13	4.79E-12	1.917E-13	7.86E-14	3.14E-13	6.28E-12	2.53E-11
8760-HOUR	2.27E+00	R_DAVIS	#VALUE!	1.799E-13	4.427E-13	2.6E-11	1.41E-13	1.883E-13	1.55E-12	1.29E-12	4.08E-12	1.93E-12	#VALUE!	1.602E-14	2.951E-13	4.29E-12	1.714E-13	7.03E-14	2.81E-13	5.62E-12	2.26E-11
8760-HOUR	2.38E+00	RESIDEN	#VALUE!	1.89E-13	4.652E-13	2.73E-11	1.48E-13	1.979E-13	1.62E-12	1.36E-12	4.28E-12	2.02E-12	#VALUE!	1.6836E-14	3.1013E-13	4.5E-12	1.802E-13	7.38E-14	2.95E-13	5.91E-12	2.38E-11
8760-HOUR	2.37E+00	COCHLAN	#VALUE!	1.878E-13	4.623E-13	2.71E-11	1.47E-13	1.966E-13	1.61E-12	1.35E-12	4.26E-12	2.01E-12	#VALUE!	1.673E-14	3.0818E-13	4.48E-12	1.79E-13	7.34E-14	2.94E-13	5.87E-12	2.36E-11
8760-HOUR	1.45E+01	N_RCKP	#VALUE!	1.152E-12	2.835E-12	1.67E-10	9E-13	1.206E-12	9.9E-12	8.28E-12	2.61E-11	1.23E-11	#VALUE!	1.0262E-13	1.8903E-12	2.75E-11	1.098E-12	4.5E-13	1.8E-12	3.6E-11	1.45E-10
8760-HOUR	1.44E+00	NW_RCKP	#VALUE!	1.14E-13	2.805E-13	1.65E-11	8.9E-14	1.193E-13	9.79E-13	8.19E-13	2.58E-12	1.22E-12	#VALUE!	1.015E-14	1.8697E-13	2.72E-12	1.086E-13	4.45E-14	1.78E-13	3.56E-12	1.43E-11
8760-HOUR	5.96E+00	S_RCKP	#VALUE!	4.724E-13	1.163E-12	6.83E-11	3.69E-13	4.946E-13	4.06E-12	3.4E-12	1.07E-11	5.06E-12	#VALUE!	4.2077E-14	7.7511E-13	1.13E-11	4.503E-13	1.85E-13	7.38E-13	1.48E-11	5.94E-11
8760-HOUR	8.21E+00	E_RCKP	#VALUE!	6.512E-13	1.603E-12	9.41E-11	5.09E-13	6.818E-13	5.6E-12	4.68E-12	1.48E-11	6.97E-12	#VALUE!	5.8E-14	1.0684E-12	1.55E-11	6.207E-13	2.54E-13	1.02E-12	2.04E-11	8.19E-11
8760-HOUR	7.00E+00	W_RCKP	#VALUE!	5.552E-13	1.366E-12	8.02E-11	4.34E-13	5.813E-13	4.77E-12	3.99E-12	1.26E-11	5.94E-12	#VALUE!	4.9451E-14	9.1093E-13	1.32E-11	5.292E-13	2.17E-13	8.68E-13	1.74E-11	6.98E-11
8760-HOUR	2.14E+00	WLDNR_N	#VALUE!	1.701E-13	4.186E-13	2.46E-11	1.33E-13	1.781E-13	1.46E-12	1.22E-12	3.85E-12	1.82E-12	#VALUE!	1.5151E-14	2.7909E-13	4.05E-12	1.621E-13	6.65E-14	2.66E-13	5.32E-12	2.14E-11
8760-HOUR	3.11E+00	WLDNR_S	#VALUE!	2.469E-13	6.077E-13	3.57E-11	1.93E-13	2.585E-13	2.12E-12	1.77E-12	5.59E-12	2.64E-12	#VALUE!	2.1994E-14	4.0515E-13	5.88E-12	2.354E-13	9.65E-14	3.86E-13	7.72E-12	3.11E-11
8760-HOUR	2.80E+00	BOB_BNB	#VALUE!	2.222E-13	5.468E-13	3.21E-11	1.74E-13	2.326E-13	1.91E-12	1.6E-12	5.03E-12	2.38E-12	#VALUE!	1.9787E-14	3.645E-13	5.29E-12	2.118E-13	8.68E-14	3.47E-13	6.94E-12	2.79E-11
8760-HOUR	3.20E-01	BLADE_R	#VALUE!	2.54E-14	6.252E-14	3.67E-12	1.98E-14	2.659E-14	2.18E-13	1.83E-13	5.76E-13	2.72E-13	#VALUE!	2.2625E-15	4.1678E-14	6.05E-13	2.421E-14	9.92E-15	3.97E-14	7.94E-13	3.2E-12
8760-HOUR	4.00E+00	LVG_GAP	#VALUE!	3.173E-13	7.808E-13	4.59E-11	2.48E-13	3.321E-13	2.73E-12	2.28E-12	7.19E-12	3.4E-12	#VALUE!	2.8256E-14	5.2051E-13	7.56E-12	3.024E-13	1.24E-13	4.96E-13	9.91E-12	3.99E-11
8760-HOUR	6.88E+00	OM_RVR	#VALUE!	5.462E-13	1.344E-12	7.89E-11	4.27E-13	5.718E-13	4.69E-12	3.93E-12	1.24E-11	5.85E-12	#VALUE!	4.8645E-14	9.8609E-13	1.3E-11	5.206E-13	2.13E-13	8.53E-13	1.71E-11	6.87E-11
8760-HOUR	6.79E+00	ATRM_EN	#VALUE!	5.383E-13	1.325E-12	7.78E-11	4.21E-13	5.636E-13	4.63E-12	3.87E-12	1.22E-11	5.76E-12	#VALUE!	4.7946E-14	8.8321E-13	1.28E-11	5.131E-13	2.1E-13	8.41E-13	1.68E-11	6.77E-11
8760-HOUR	4.44E+00	CBN_RDG	#VALUE!	3.526E-13	8.677E-13	5.1E-11	2.75E-13	3.691E-13	3.03E-12	2.53E-12	7.99E-12	3.77E-12	#VALUE!	3.1401E-14	5.7843E-13	8.4E-12	3.36E-13	1.38E-13	5.51E-13	1.1E-11	4.43E-11
8760-HOUR	3.84E+00	CR_HM_EN	#VALUE!	3.05E-13	7.505E-13	4.41E-11	2.38E-13	3.193E-13	2.62E-12	2.19E-12	6.91E-12	3.26E-12	#VALUE!	2.7161E-14	5.0033E-13	7.27E-12	2.907E-13	1.19E-13	4.77E-13	9.53E-12	3.84E-11
8760-HOUR	3.48E+00	HNYMNCRK	#VALUE!	2.761E-13	6.794E-13	3.99E-11	2.16E-13	2.89E-13	2.37E-12	1.98E-12	6.25E-12	2.95E-12	#VALUE!	2.4588E-14	4.5294E-13	6.58E-12	2.631E-13	1.08E-13	4.31E-13	8.63E-12	3.47E-11
8760-HOUR	1.21E+01	BLADE_C	#VALUE!	9.597E-13	2.362E-12	1.39E-10	7.5E-13	1.005E-12	8.25E-12	6.9E-12	2.17E-11	1.03E-11	#VALUE!	8.5472E-14	1.5745E-12	2.29E-11	9.147E-13	3.75E-13	1.5E-12	3E-11	1.21E-10
8760-HOUR	1.20E+01	MCLY_CRK	#VALUE!	9.492E-13	2.336E-12	1.37E-10	7.42E-13	9.937E-13	8.1												

The Pekisko Group
Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies

SO TSP - Concentration: [ug/m**3]			Total deposition (Dtot, ug/m2/year)																		
Average Period	100th Percentile (1st Highest)	Receptor ID	n/a	1.28E-06	3.15E-06	1.85E-04	1.00E-06	1.34E-06	1.10E-05	9.20E-06	2.90E-05	1.37E-05	n/a	1.14E-07	2.10E-06	3.05E-05	1.22E-06	5.00E-07	2.00E-06	4.00E-05	1.61E-04
	MPOI		Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
8760-HOUR	3.60E+03	716	#VALUE!	0.0090406	0.0222484	1.306654	0.007063	0.0094644	0.077693	0.06498	0.204827	0.096763	#VALUE!	0.00080518	0.01483229	0.215421	0.0086169	0.003531	0.014126	0.28252	1.137142
	Sensitive		#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0
8760-HOUR	2.55E-01	CARTWRT	#VALUE!	6.41E-07	1.577E-06	9.26E-05	5.01E-07	6.71E-07	5.51E-06	4.61E-06	1.45E-05	6.86E-06	#VALUE!	5.7085E-08	1.0516E-06	1.53E-05	6.109E-07	2.5E-07	1E-06	2E-05	8.06E-05
8760-HOUR	2.72E+00	CHIMNEY	#VALUE!	6.852E-06	1.686E-05	0.00099	5.35E-06	7.173E-06	5.89E-05	4.92E-05	0.000155	7.33E-05	#VALUE!	6.1025E-07	1.1241E-05	0.000163	6.531E-06	2.68E-06	1.07E-05	0.000214	0.000862
8760-HOUR	4.31E-01	BB_RANCH	#VALUE!	1.085E-06	2.67E-06	0.000157	8.48E-07	1.136E-06	9.33E-06	7.8E-06	2.46E-05	1.16E-05	#VALUE!	9.6642E-08	1.7802E-06	2.59E-05	1.034E-06	4.24E-07	1.7E-06	3.39E-05	0.000136
8760-HOUR	4.70E+00	RH_CRK	#VALUE!	1.181E-05	2.907E-05	0.001707	9.23E-06	1.237E-05	0.000102	8.49E-05	0.000268	0.000126	#VALUE!	1.0521E-06	1.938E-05	0.000281	1.126E-05	4.61E-06	1.85E-05	0.000369	0.001486
8760-HOUR	2.76E-01	CTRT_CRK	#VALUE!	6.947E-07	1.71E-06	0.0001	5.43E-07	7.272E-07	5.97E-06	4.99E-06	1.57E-05	7.44E-06	#VALUE!	6.1869E-08	1.1397E-06	1.66E-05	6.621E-07	2.71E-07	1.09E-06	2.17E-05	8.74E-05
8760-HOUR	2.41E+00	QLDM_RF	#VALUE!	6.053E-06	1.49E-05	0.000875	4.73E-06	6.337E-06	5.2E-05	4.35E-05	0.000137	6.48E-05	#VALUE!	5.3908E-07	9.9305E-06	0.000144	5.769E-06	2.36E-06	9.46E-06	0.000189	0.000761
8760-HOUR	1.91E+01	LVST_F	#VALUE!	4.805E-05	0.0001183	0.006945	3.75E-05	5.031E-05	0.000413	0.000345	0.001089	0.000514	#VALUE!	4.2797E-06	7.8837E-05	0.001145	4.58E-05	1.88E-05	7.51E-05	0.001502	0.006044
8760-HOUR	6.27E+00	PLT_MC	#VALUE!	1.578E-05	3.883E-05	0.002281	1.23E-05	1.652E-05	0.000136	0.000113	0.000357	0.000169	#VALUE!	1.4053E-06	2.5887E-05	0.000376	1.504E-05	6.16E-06	2.47E-05	0.000493	0.001985
8760-HOUR	4.31E-01	C_GARDN	#VALUE!	1.085E-06	2.67E-06	0.000157	8.47E-07	1.136E-06	9.32E-06	7.8E-06	2.46E-05	1.16E-05	#VALUE!	9.6613E-08	1.7797E-06	2.58E-05	1.034E-06	4.24E-07	1.69E-06	3.39E-05	0.000136
8760-HOUR	3.72E-01	S_GARDN	#VALUE!	9.358E-07	2.303E-06	0.000135	7.31E-07	9.797E-07	8.04E-06	6.73E-06	2.12E-05	1E-05	#VALUE!	8.3344E-08	1.5353E-06	2.23E-05	8.919E-07	3.66E-07	1.46E-06	2.92E-05	0.000118
8760-HOUR	7.41E-01	RLND_MB	#VALUE!	1.864E-06	4.587E-06	0.000269	1.46E-06	1.951E-06	1.6E-05	1.34E-05	4.22E-05	1.99E-05	#VALUE!	1.6601E-07	3.058E-06	4.44E-05	1.777E-06	7.28E-07	2.91E-06	5.82E-05	0.000234
8760-HOUR	2.07E+00	R_BLAKE	#VALUE!	5.194E-06	1.278E-05	0.000751	4.06E-06	5.438E-06	4.46E-05	3.73E-05	0.000118	5.56E-05	#VALUE!	4.6261E-07	8.5217E-06	0.000124	4.951E-06	2.03E-06	8.12E-06	0.000162	0.000653
8760-HOUR	1.97E+00	B_RANSOM	#VALUE!	4.946E-06	1.217E-05	0.000715	3.86E-06	5.177E-06	4.25E-05	3.55E-05	0.000112	5.29E-05	#VALUE!	4.4047E-07	8.1139E-06	0.000118	4.714E-06	1.93E-06	7.73E-06	0.000155	0.000622
8760-HOUR	1.68E+00	RCKP_PLG	#VALUE!	4.235E-06	1.042E-05	0.000612	3.31E-06	4.434E-06	3.64E-05	3.04E-05	9.6E-05	4.53E-05	#VALUE!	3.7719E-07	6.9482E-06	0.000101	4.037E-06	1.65E-06	6.62E-06	0.000132	0.000533
8760-HOUR	2.53E+00	S_HARVEY	#VALUE!	6.374E-06	1.569E-05	0.000921	4.98E-06	6.673E-06	5.48E-05	4.58E-05	0.000144	6.82E-05	#VALUE!	5.6772E-07	1.0458E-05	0.000152	6.076E-06	2.49E-06	9.96E-06	0.000199	0.000802
8760-HOUR	2.27E+00	R_DAVIS	#VALUE!	5.701E-06	1.403E-05	0.000824	4.45E-06	5.969E-06	4.9E-05	4.1E-05	0.000129	6.1E-05	#VALUE!	5.0778E-07	9.3539E-06	0.000136	5.434E-06	2.23E-06	8.91E-06	0.000178	0.000717
8760-HOUR	2.38E+00	RESIDEN	#VALUE!	5.992E-06	1.475E-05	0.000866	4.68E-06	6.273E-06	5.15E-05	4.31E-05	0.000136	6.41E-05	#VALUE!	5.3364E-07	9.8302E-06	0.000143	5.711E-06	2.34E-06	9.36E-06	0.000187	0.000754
8760-HOUR	2.37E+00	COCHLAN	#VALUE!	5.954E-06	1.465E-05	0.000861	4.65E-06	6.233E-06	5.12E-05	4.28E-05	0.000135	6.37E-05	#VALUE!	5.3029E-07	9.7685E-06	0.000142	5.675E-06	2.33E-06	9.3E-06	0.000186	0.000749
8760-HOUR	1.45E+01	N_RCKP	#VALUE!	3.652E-05	8.988E-05	0.005279	2.85E-05	3.823E-05	0.000314	0.000262	0.000827	0.000391	#VALUE!	3.2527E-06	5.9918E-05	0.00087	3.481E-05	1.43E-05	5.71E-05	0.001141	0.004594
8760-HOUR	1.44E+00	NW_RCKP	#VALUE!	3.612E-06	8.89E-06	0.000522	2.82E-06	3.782E-06	3.1E-05	2.6E-05	8.18E-05	3.87E-05	#VALUE!	3.2172E-07	5.9264E-06	8.61E-05	3.443E-06	1.41E-06	5.64E-06	0.000113	0.000454
8760-HOUR	5.96E+00	S_RCKP	#VALUE!	1.498E-05	3.685E-05	0.002164	1.17E-05	1.568E-05	0.000129	0.000108	0.000339	0.00016	#VALUE!	1.3337E-06	2.4569E-05	0.000357	1.427E-05	5.85E-06	2.34E-05	0.000468	0.001884
8760-HOUR	8.21E+00	E_RCKP	#VALUE!	2.064E-05	5.08E-05	0.002983	1.61E-05	2.161E-05	0.000177	0.000148	0.000468	0.000221	#VALUE!	1.8385E-06	3.3866E-05	0.000492	1.967E-05	8.06E-06	3.23E-05	0.000645	0.002596
8760-HOUR	7.00E+00	W_RCKP	#VALUE!	1.76E-05	4.331E-05	0.002544	1.37E-05	1.842E-05	0.000151	0.000126	0.000399	0.000188	#VALUE!	1.5675E-06	2.8874E-05	0.000419	1.677E-05	6.87E-06	2.75E-05	0.00055	0.002214
8760-HOUR	2.14E+00	WLDNRN_N	#VALUE!	5.392E-06	1.327E-05	0.000779	4.21E-06	5.645E-06	4.63E-05	3.88E-05	0.000122	5.77E-05	#VALUE!	4.8024E-07	8.8464E-06	0.000128	5.139E-06	2.11E-06	8.43E-06	0.000169	0.000678
8760-HOUR	3.11E+00	WLDNRN_S	#VALUE!	7.828E-06	1.926E-05	0.001131	6.12E-06	8.194E-06	6.73E-05	5.63E-05	0.000177	8.38E-05	#VALUE!	6.9714E-07	1.2842E-05	0.000187	7.461E-06	3.06E-06	1.22E-05	0.000245	0.000985
8760-HOUR	2.80E+00	BOB_BNB	#VALUE!	7.042E-06	1.733E-05	0.001018	5.5E-06	7.372E-06	6.05E-05	5.06E-05	0.00016	7.54E-05	#VALUE!	6.272E-07	1.1554E-05	0.000168	6.712E-06	2.75E-06	1.1E-05	0.00022	0.000886
8760-HOUR	3.20E-01	BLADE_R	#VALUE!	8.052E-07	1.982E-06	0.000116	6.29E-07	8.43E-07	6.92E-06	5.79E-06	1.82E-05	8.62E-06	#VALUE!	7.1716E-08	1.3211E-06	1.92E-05	6.75E-07	3.15E-07	1.26E-06	2.52E-05	0.000101
8760-HOUR	4.00E+00	LVG_GAP	#VALUE!	1.006E-05	2.475E-05	0.001453	7.86E-06	1.053E-05	8.64E-05	7.23E-05	0.000228	0.000108	#VALUE!	8.9564E-07	1.6499E-05	0.00024	9.585E-06	3.93E-06	1.57E-05	0.000314	0.001265
8760-HOUR	6.88E+00	OM_RVR	#VALUE!	1.731E-05	4.261E-05	0.002502	1.35E-05	1.812E-05	0.000149	0.000124	0.000392	0.000185	#VALUE!	1.5419E-06	2.8404E-05	0.000413	1.65E-05	6.76E-06	2.71E-05	0.000541	0.002178
8760-HOUR	6.79E+00	ATRM_EN	#VALUE!	1.706E-05	4.199E-05	0.002466	1.33E-05	1.786E-05	0.000147	0.000123	0.000387	0.000183	#VALUE!	1.5197E-06	2.7995E-05	0.000407	1.626E-05	6.67E-06	2.67E-05	0.000533	0.002146
8760-HOUR	4.44E+00	CBN_RDG	#VALUE!	1.118E-05	2.75E-05	0.001615	7.83E-06	1.17E-05	9.6E-05	8.03E-05	0.000253	0.00012	#VALUE!	9.9532E-07	1.8335E-05	0.000266	1.065E-05	4.37E-06	1.75E-05	0.000349	0.001406
8760-HOUR	3.84E+00	CR_HM_EN	#VALUE!	9.666E-06	2.379E-05	0.001397	7.55E-06	1.012E-05	8.31E-05	6.95E-05	0.000219	0.000103	#VALUE!	8.6092E-07	1.5859E-05	0.00023	9.213E-06	3.78E-06	1.51E-05	0.000302	0.001216
8760-HOUR	3.48E+00	HNVMNCRK	#VALUE!	8.751E-06	2.154E-05	0.001265	6.84E-06	9.161E-06	7.52E-05	6.29E-05	0.000198	9.37E-05	#VALUE!	7.7938E-07	1.4357E-05	0.000209	8.341E-06	3.42E-06	1.37E-05	0.000273	0.001101
8760-HOUR	1.21E+01	BLADE_C	#VALUE!	3.042E-05	7.486E-05	0.004397	2.38E-05	3.185E-05	0.000261	0.000219	0.000689	0.000326	#VALUE!	2.7092E-06	4.9907E-05	0.000725	2.899E-05	1.19E-05	4.75E-05	0.000951	0.003826
8760-HOUR	1.20E+01	MCLY_CRK	#VALUE!	3.009E-05	7.404E-05	0.004349	2.35E-05	3.15E-05	0.000259	0.000216											

The Pekisko Group
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Livingstone Range – Canadian Rockies

SO TSP - Concentration: [ug/m**3]			Deposition to surface soil (mg/kg/year)															
Average Period	100th Percentile (1st Highest)	Receptor ID																
MPOI			Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Moioydaenu m	Nickel	Selenium	Thallium
8760-HOUR	3.60E+03	716	#VALUE!	3.0135E-07	7.4161E-07	4.3555E-05	2.3543E-07	3.1548E-07	2.5898E-06	2.166E-06	6.8276E-06	3.2254E-06	#VALUE!	2.6839E-08	4.9441E-07	7.1807E-06	2.8723E-07	1.1772E-07
Sensitive			#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0
8760-HOUR	2.55E-01	CARTWRT	#VALUE!	2.1365E-11	5.2579E-11	3.0879E-09	1.6692E-11	2.2367E-11	1.8361E-10	1.5356E-10	4.8406E-10	2.2868E-10	#VALUE!	1.9028E-12	3.5052E-11	5.0909E-10	2.0364E-11	8.3458E-12
8760-HOUR	2.72E+00	CHIMNEY	#VALUE!	2.284E-10	5.6207E-10	3.3011E-08	1.7844E-10	2.391E-10	1.9628E-09	1.6416E-09	5.1746E-09	2.4446E-09	#VALUE!	2.0342E-11	3.7471E-10	5.4423E-09	2.1769E-10	8.9218E-11
8760-HOUR	4.31E-01	BB_RANCH	#VALUE!	3.617E-11	8.9012E-11	5.2277E-09	2.8258E-11	3.7865E-11	3.1084E-10	2.5997E-10	8.1948E-10	3.8713E-10	#VALUE!	3.2214E-12	5.9341E-11	8.6186E-10	3.4475E-11	1.4129E-11
8760-HOUR	4.70E+00	RH_CRK	#VALUE!	3.9375E-10	9.69E-10	5.6909E-08	3.0762E-10	4.1221E-10	3.3838E-09	2.8301E-09	8.9209E-09	4.2144E-09	#VALUE!	3.5068E-11	6.46E-10	9.3823E-09	3.7529E-10	1.5381E-10
8760-HOUR	2.76E-01	CTRT_CRK	#VALUE!	2.3156E-11	5.6985E-11	3.3467E-09	1.809E-11	2.4241E-11	1.9899E-10	1.6643E-10	5.2462E-10	2.4784E-10	#VALUE!	2.0623E-12	3.799E-11	5.5176E-10	2.207E-11	9.0452E-12
8760-HOUR	2.41E+00	QLDM_RF	#VALUE!	2.0176E-10	4.9652E-10	2.9161E-08	1.5763E-10	2.1122E-10	1.7339E-09	1.4502E-09	4.5712E-09	2.1595E-09	#VALUE!	1.7969E-11	3.3102E-10	4.8076E-09	1.923E-10	7.8813E-11
8760-HOUR	1.91E+01	LVST_F	#VALUE!	1.6018E-09	3.9418E-09	2.3151E-07	1.2514E-09	1.6768E-09	1.3765E-08	1.1513E-08	3.629E-08	1.7144E-08	#VALUE!	1.4266E-10	2.6279E-09	3.8167E-08	1.5267E-09	6.2569E-09
8760-HOUR	6.27E+00	PLT_MC	#VALUE!	5.2596E-10	1.2944E-09	7.6017E-08	4.1091E-10	5.5061E-10	4.52E-09	3.7803E-09	1.1916E-08	5.6294E-09	#VALUE!	4.6843E-11	8.629E-10	1.2533E-08	5.013E-10	2.0545E-10
8760-HOUR	4.31E-01	C_GARDN	#VALUE!	3.6159E-11	8.8985E-11	5.2261E-09	2.8249E-11	3.7854E-11	3.1074E-10	2.5898E-10	8.1923E-10	3.8702E-10	#VALUE!	3.2204E-12	5.9324E-11	8.616E-10	3.4464E-11	1.4125E-11
8760-HOUR	3.72E-01	S_GARDN	#VALUE!	3.1193E-11	7.6764E-11	4.5083E-09	2.4369E-11	3.2655E-11	2.6806E-10	2.242E-10	7.0671E-10	3.3386E-10	#VALUE!	2.7781E-12	5.1176E-11	7.4327E-10	2.9731E-11	1.2185E-11
8760-HOUR	7.41E-01	RLND_MB	#VALUE!	6.2131E-11	1.529E-10	8.9799E-09	4.854E-11	6.5043E-11	5.3394E-10	4.657E-10	1.4077E-09	6.65E-10	#VALUE!	5.5335E-12	1.0193E-10	1.4805E-09	5.9219E-11	2.427E-11
8760-HOUR	2.07E+00	R_BLAKE	#VALUE!	1.7314E-10	4.2609E-10	2.5024E-08	1.3527E-10	1.8126E-10	1.4879E-09	1.2444E-09	3.9227E-09	1.8531E-09	#VALUE!	1.542E-11	2.8406E-10	4.1256E-09	1.6502E-10	6.7633E-11
8760-HOUR	1.97E+00	B_RANSOM	#VALUE!	1.6485E-10	4.057E-10	2.3827E-08	1.2879E-10	1.7258E-10	1.4167E-09	1.1849E-09	3.735E-09	1.7645E-09	#VALUE!	1.4682E-11	2.7046E-10	3.9282E-09	1.5713E-10	6.4396E-11
8760-HOUR	1.68E+00	RCKP_PLG	#VALUE!	1.4117E-10	3.4741E-10	2.0403E-10	1.1029E-10	1.4779E-10	1.2132E-09	1.0147E-09	3.1984E-09	1.511E-09	#VALUE!	1.2573E-11	2.3161E-10	3.3638E-09	1.3455E-10	5.5144E-11
8760-HOUR	2.53E+00	S_HARVEY	#VALUE!	2.1248E-10	5.229E-10	3.071E-08	1.66E-10	2.2244E-10	1.826E-09	1.5272E-09	4.814E-09	2.2742E-09	#VALUE!	1.8924E-11	3.486E-10	5.063E-09	2.0252E-10	8.3E-11
8760-HOUR	2.27E+00	R_DAVIS	#VALUE!	1.9005E-10	4.677E-10	2.7468E-08	1.4847E-10	1.9896E-10	1.6332E-09	1.366E-09	4.3058E-09	2.0341E-09	#VALUE!	1.6926E-11	3.118E-10	4.5285E-09	1.8114E-10	7.4237E-11
8760-HOUR	2.38E+00	RESIDEN	#VALUE!	1.9973E-10	4.9151E-10	2.8867E-08	1.5604E-10	2.0909E-10	1.7164E-09	1.4355E-09	4.525E-09	1.2377E-09	#VALUE!	1.7788E-11	3.2767E-10	4.7591E-09	1.9036E-10	7.8018E-11
8760-HOUR	2.37E+00	COCHLAN	#VALUE!	1.9847E-10	4.8843E-10	2.8685E-08	1.5506E-10	2.0778E-10	1.7056E-09	1.4265E-09	4.4966E-09	2.1243E-09	#VALUE!	1.7676E-11	3.2562E-10	4.7292E-09	1.8917E-10	7.7528E-11
8760-HOUR	1.45E+01	N_RCKP	#VALUE!	1.2174E-09	2.9959E-09	1.7959E-07	9.5108E-10	1.2745E-09	1.0462E-08	8.75E-09	2.7581E-08	1.303E-08	#VALUE!	1.0842E-10	1.9973E-09	2.9008E-08	1.1603E-09	4.7554E-08
8760-HOUR	1.44E+00	NW_RCKP	#VALUE!	1.2041E-10	2.9632E-10	1.7403E-08	9.407E-11	1.2605E-10	1.0348E-09	8.6545E-10	2.728E-09	1.2888E-09	#VALUE!	1.0724E-11	1.9755E-10	2.8691E-09	1.1477E-10	4.7035E-11
8760-HOUR	5.96E+00	S_RCKP	#VALUE!	4.9918E-10	1.2284E-09	7.2147E-08	3.8998E-10	5.2258E-10	4.2898E-09	3.5878E-09	1.1309E-08	5.3428E-09	#VALUE!	4.4458E-11	8.1896E-10	1.1894E-08	4.7578E-10	1.9499E-10
8760-HOUR	8.21E+00	E_RCKP	#VALUE!	6.8808E-10	1.6933E-09	9.9449E-08	5.3756E-10	7.2033E-10	5.9132E-09	4.9455E-09	1.5589E-08	7.3646E-09	#VALUE!	6.1282E-11	1.1289E-09	1.6396E-08	6.5582E-10	2.6878E-10
8760-HOUR	7.00E+00	W_RCKP	#VALUE!	5.8665E-10	1.4437E-09	4.8789E-08	4.5832E-10	6.1415E-10	5.0415E-09	4.2165E-09	1.3291E-08	6.279E-09	#VALUE!	5.2248E-11	9.6247E-10	1.3979E-08	5.5915E-10	2.2916E-10
8760-HOUR	2.14E+00	WLDNRN_N	#VALUE!	1.7974E-10	4.4232E-10	2.5978E-08	1.4042E-10	1.8816E-10	1.5446E-09	1.2919E-09	4.0722E-09	1.9237E-09	#VALUE!	1.6008E-11	2.9488E-10	4.2828E-09	1.7131E-10	7.021E-11
8760-HOUR	3.11E+00	WLDNRN_S	#VALUE!	2.6092E-10	6.421E-10	3.7711E-08	2.0384E-10	2.7315E-10	2.2423E-09	1.8753E-09	5.9114E-09	2.7926E-09	#VALUE!	2.3238E-11	4.2807E-10	6.2172E-09	2.4869E-10	1.0192E-10
8760-HOUR	2.80E+00	BOB_BNB	#VALUE!	2.3474E-10	5.7769E-10	3.3928E-08	1.8339E-10	2.4575E-10	2.0173E-09	1.6872E-09	5.3184E-09	2.5125E-09	#VALUE!	2.0907E-11	3.8513E-10	5.5935E-09	2.2374E-10	9.1697E-11
8760-HOUR	3.20E-01	BLADE_R	#VALUE!	2.6841E-11	6.6054E-11	3.8794E-09	2.097E-11	2.8099E-11	2.3067E-10	1.9292E-10	6.0812E-10	2.8728E-10	#VALUE!	2.3905E-12	4.4036E-11	6.3957E-10	2.5583E-11	1.0485E-11
8760-HOUR	4.00E+00	LVG_GAP	#VALUE!	3.3521E-10	8.2493E-10	4.8449E-08	2.6188E-10	3.5092E-10	2.8807E-09	2.4093E-09	7.5946E-09	3.5878E-09	#VALUE!	2.9855E-11	5.4996E-10	7.9875E-09	3.195E-10	1.3094E-10
8760-HOUR	6.88E+00	OM_RVR	#VALUE!	5.7709E-10	1.4202E-09	8.3408E-08	4.5085E-10	6.0414E-10	4.9594E-09	4.1478E-09	1.3075E-08	1.6767E-09	#VALUE!	5.1397E-11	9.4679E-10	1.3751E-08	5.5004E-10	2.2543E-10
8760-HOUR	6.79E+00	ATRM_EN	#VALUE!	5.6879E-10	1.3998E-09	8.2208E-08	4.4437E-10	9.9546E-10	4.8881E-09	4.0882E-09	1.2887E-08	6.0879E-09	#VALUE!	5.0658E-11	9.3318E-10	1.3553E-08	5.4213E-10	2.2218E-10
8760-HOUR	4.44E+00	CBN_RDG	#VALUE!	3.7252E-10	9.1674E-10	5.384E-08	2.9103E-10	3.8998E-10	3.2013E-09	2.6775E-09	8.4399E-09	3.9871E-09	#VALUE!	3.3177E-11	6.1116E-10	8.8764E-09	3.5506E-10	1.4551E-10
8760-HOUR	3.84E+00	CR_HM_EN	#VALUE!	3.221E-10	7.9295E-10	4.657E-08	2.5173E-10	3.332E-10	2.769E-09	2.3159E-09	7.3002E-09	3.4487E-09	#VALUE!	2.8697E-11	5.2863E-10	7.6778E-09	3.0711E-10	1.2586E-10
8760-HOUR	3.48E+00	HNMYNCRK	#VALUE!	2.917E-10	7.1785E-10	4.2159E-08	2.2789E-10	3.0537E-10	2.5068E-09	2.0966E-09	6.6088E-09	3.1221E-09	#VALUE!	2.5979E-11	4.7857E-10	6.9506E-09	2.7802E-10	1.1394E-10
8760-HOUR	1.21E+01	BLADE_C	#VALUE!	1.014E-09	2.4954E-09	1.4655E-07	7.9218E-10	1.0615E-09	8.714E-09	7.288E-09	2.2973E-08	1.0853E-08	#VALUE!	9.0308E-11	1.6636E-09	2.4161E-08	9.6646E-10	3.9609E-10
8760-HOUR	1.20E+01	MCLY_CRK	#VALUE!	1.0029E-09	2.4681E-09	1.4495E-07	7.8353E-10	1.0499E-09	8.6189E-09	2.7085E-09	2.2722E-08	1.0734E-08	#VALUE!	8.9323E-11	1.6454E-09	2.3898E-08	9.5591E-10	3.9177E-10
8760-HOUR	3.57E+00	DENNIS	#VALUE!	2.9897E-10	7.3576E-10	4.3211E-08	2.3357E-10	3.1299E-10	2.5693E-09	2.1489E-09	6.7736E-09	3.2E-09	#VALUE!	2.6627E-11	4.905E-10	7.124E-09	2.8496E-10	1.1679E-10
8760-HOUR	1.31E+01	PLT_NE	#VALUE!	1.0944E-09	2.6932E-09	1.5817E-07	8.5498E-10	1.1457E-09	9.4048E-09	7.8658E-09	2.4794E-08	1.1713E-08	#VALUE!	9.7468E-11	1.7955E-09	2.6077E-08	1.0431E-09	4.2749E-10
8760-HOUR	1.07E+00	PLT_NW	#VALUE!	8.9957E-11	2.2138E-10	1.300												

S0 TSP - Concentration: [ug/m**3]			Concentration in Surface Soil (mg/kg)																			
Average Period	100th Percentile (1st Highest)	Receptor ID		Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Mo	Nickel	Selenium	Thallium	Uranium	Vanadium	Zinc
MPOI																						
8760-HOUR	3.60E+03	716	#VALUE!	0.58400552	1.43720109	84.407048	0.45625431	0.61138078	5.01879745	4.19753968	13.2313751	6.25068409	#VALUE!	0.05201299	0.95813406	13.9157566	0.55663026	0.22812716	0.91250863	18.2501725	73.4569444	
	Sensitive		#VALUE!	0	0	0	0	0	0	0	0	0	#VALUE!	0	0	0	0	0	0	0	0	0
8760-HOUR	2.55E-01	CARTWRT	#VALUE!	4.1405E-05	0.00010189	0.00598425	3.2347E-05	4.3345E-05	0.00035582	0.0002976	0.00093807	0.00044316	#VALUE!	3.6876E-06	6.7929E-05	0.00098659	3.9464E-05	1.6174E-05	6.4695E-05	0.00129389	0.00520791	
8760-HOUR	2.72E+00	CHIMNEY	#VALUE!	0.00044262	0.00108926	0.06397237	0.0003458	0.00046337	0.00380376	0.00318133	0.0100281	0.00473741	#VALUE!	3.9421E-05	0.00072617	0.0105468	0.00042187	0.0001729	0.00069159	0.00138186	0.05567326	
8760-HOUR	4.31E-01	BB_RANCH	#VALUE!	7.0095E-05	0.0001725	0.01013094	5.4762E-05	7.3381E-05	0.00060238	0.00050381	0.00158809	0.00075024	#VALUE!	6.2428E-06	0.000115	0.00167024	6.6809E-05	2.7381E-05	0.00010952	0.00219407	0.00881665	
8760-HOUR	4.70E+00	RH_CRK	#VALUE!	0.00076306	0.00187785	0.11028643	0.00059614	0.00079883	0.00655757	0.00548451	0.01728814	0.00816716	#VALUE!	6.796E-05	0.0012519	0.01818236	0.00072729	0.00029807	0.00119229	0.02384571	0.095979	
8760-HOUR	2.76E-01	CTRT_CRK	#VALUE!	4.4874E-05	0.00011043	0.00648575	3.5058E-05	4.6978E-05	0.00038564	0.00032253	0.00101669	0.0004803	#VALUE!	3.9966E-06	7.3622E-05	0.00106927	4.2771E-05	1.7529E-05	7.0116E-05	0.00140232	0.00564436	
8760-HOUR	2.41E+00	OLDM_RF	#VALUE!	0.000391	0.00096223	0.05651202	0.00030547	0.00040933	0.00336017	0.00281033	0.00885864	0.00418494	#VALUE!	3.4824E-05	0.00064149	0.00931685	0.00037267	0.00015274	0.00061094	0.0121882	0.04918073	
8760-HOUR	1.91E+01	LVST_F	#VALUE!	0.00310412	0.00763905	0.44864246	0.00242509	0.00324963	0.02667604	0.02231087	0.07032774	0.03322379	#VALUE!	0.00027646	0.0050927	0.07396538	0.00295862	0.00121255	0.00485019	0.09700378	0.39044019	
8760-HOUR	6.27E+00	PLT_MC	#VALUE!	0.00101927	0.00250837	0.14731701	0.00079631	0.00106705	0.00875939	0.00732604	0.02309294	0.01090942	#VALUE!	9.0779E-05	0.00167225	0.0242874	0.0009715	0.00039815	0.00159262	0.03185233	0.12820562	
8760-HOUR	4.31E-01	C_GARDN	#VALUE!	7.0074E-05	0.00017245	0.01012788	5.4745E-05	7.3359E-05	0.0006022	0.00050366	0.00158761	0.00075001	#VALUE!	6.241E-06	0.00011497	0.00166973	6.6789E-05	2.7373E-05	0.00010949	0.00218981	0.008814	
8760-HOUR	3.72E-01	S_GARDN	#VALUE!	6.045E-05	0.00014876	0.00873689	4.7226E-05	6.3283E-05	0.00051949	0.00043448	0.00136957	0.000647	#VALUE!	5.3838E-06	9.9175E-05	0.00144041	5.7616E-05	2.3613E-05	9.4453E-05	0.00188906	0.00760345	
8760-HOUR	7.41E-01	RIND_MB	#VALUE!	0.00012041	0.00029631	0.0174024	9.4067E-05	0.00012605	0.00103474	0.00086542	0.00272794	0.00128872	#VALUE!	1.0724E-05	0.00019754	0.00286904	0.00011476	4.7034E-05	0.00018813	0.00376268	0.01514479	
8760-HOUR	2.07E+00	R_BLAKE	#VALUE!	0.00033553	0.00082573	0.04849522	0.00026214	0.00035126	0.0028835	0.00241165	0.00760195	0.00359127	#VALUE!	2.9884E-05	0.00055049	0.00799516	0.00031981	0.00013107	0.00052427	0.01048545	0.04220395	
8760-HOUR	1.97E+00	B_RANSOM	#VALUE!	0.00031948	0.00078621	0.04617436	0.00024959	0.00033445	0.0027455	0.00229624	0.00723814	0.0034194	#VALUE!	2.8453E-05	0.00052414	0.00761253	0.0003045	0.0001248	0.00049918	0.00983634	0.04018417	
8760-HOUR	1.68E+00	RCKP_PLC	#VALUE!	0.00027358	0.00067326	0.03954045	0.00021373	0.00028164	0.00235105	0.00196634	0.00619823	0.00292813	#VALUE!	2.4365E-05	0.00044884	0.00051883	0.00026075	0.00010687	0.00042746	0.00854929	0.03441088	
8760-HOUR	2.53E+00	S_HARVEY	#VALUE!	0.00041177	0.00101334	0.05951377	0.0003217	0.00043187	0.00353866	0.0029596	0.00932919	0.00440724	#VALUE!	3.6673E-05	0.00067556	0.00981173	0.00039247	0.00016085	0.00064339	0.01286784	0.05179307	
8760-HOUR	2.27E+00	R_DAVIS	#VALUE!	0.0003683	0.00090636	0.05323088	0.00028773	0.00038556	0.00316508	0.00264716	0.0083443	0.00394196	#VALUE!	3.2802E-05	0.00060424	0.0087759	0.00035104	0.00014387	0.00057547	0.01150938	0.04632525	
8760-HOUR	2.38E+00	RESIDEN	#VALUE!	0.00038705	0.00095252	0.05594149	0.00030239	0.0004052	0.00332625	0.00278196	0.00876921	0.00414269	#VALUE!	3.4472E-05	0.00063501	0.00922279	0.00036891	0.00015119	0.00060477	0.01209546	0.04868422	
8760-HOUR	2.37E+00	COCHLAN	#VALUE!	0.00038463	0.00094654	0.05590408	0.00030409	0.00040266	0.00330538	0.0027845	0.00871418	0.0041167	#VALUE!	3.4256E-05	0.00063103	0.00916492	0.0003666	0.00015024	0.00060098	0.01201956	0.04837875	
8760-HOUR	1.45E+01	N_RCKP	#VALUE!	0.00235922	0.00580589	0.34098095	0.00184314	0.00246981	0.02027454	0.01695689	0.05345107	0.02525102	#VALUE!	0.00021012	0.00387059	0.05621578	0.00224863	0.00092157	0.00368628	0.07372561	0.29674558	
8760-HOUR	1.44E+00	NW_RCKP	#VALUE!	0.00023335	0.00057425	0.03372596	0.0001823	0.00024299	0.00200533	0.00167718	0.00528677	0.00249754	#VALUE!	2.0782E-05	0.00038284	0.00556023	0.00022241	9.1151E-05	0.0003646	0.0072921	0.0293507	
8760-HOUR	5.96E+00	S_RCKP	#VALUE!	0.00096737	0.00238064	0.13981557	0.00075576	0.00101272	0.00831336	0.00695299	0.02191704	0.01035391	#VALUE!	8.6157E-05	0.0015871	0.02305068	0.00092203	0.00037788	0.00015112	0.00320309	0.12167734	
8760-HOUR	8.21E+00	E_RCKP	#VALUE!	0.00133345	0.00328153	0.19272479	0.00104176	0.00139595	0.01145931	0.00958415	0.03021091	0.01427205	#VALUE!	0.00011876	0.00218769	0.03177355	0.00127094	0.00052088	0.00208351	0.04167022	0.16772265	
8760-HOUR	7.00E+00	W_RCKP	#VALUE!	0.00113689	0.00279781	0.16431558	0.00088819	0.00119018	0.00977012	0.00817137	0.02575758	0.01216823	#VALUE!	0.00010125	0.0018652	0.02708987	0.00108359	0.0004441	0.00017638	0.03552769	0.14299896	
8760-HOUR	2.14E+00	WLDNR_N	#VALUE!	0.00034832	0.00085719	0.050343	0.00027212	0.00036465	0.00299337	0.00250354	0.0078916	0.0037281	#VALUE!	3.1022E-05	0.00057146	0.00829979	0.00033199	0.00013806	0.00054425	0.01088497	0.04381201	
8760-HOUR	3.11E+00	WLDNR_S	#VALUE!	0.00050564	0.00124435	0.07308093	0.00039503	0.00052934	0.00434535	0.00363429	0.01145593	0.00541194	#VALUE!	4.5034E-05	0.00082957	0.01204848	0.00048194	0.00019752	0.00079006	0.01580128	0.06360016	
8760-HOUR	2.80E+00	BOB_BNB	#VALUE!	0.00045492	0.00111952	0.06574971	0.00033554	0.00047624	0.00390944	0.00326972	0.01030671	0.00486903	#VALUE!	4.0516E-05	0.00074635	0.01083982	0.00043359	0.0001777	0.00071081	0.01421615	0.05222002	
8760-HOUR	3.20E-01	BLADE_R	#VALUE!	5.2016E-05	0.00012801	0.00751799	4.0638E-05	5.4455E-05	0.00044702	0.00037387	0.0011785	0.00055674	#VALUE!	4.6327E-06	8.5339E-05	0.00123945	4.9578E-05	2.0319E-05	8.1276E-05	0.00162551	0.00654269	
8760-HOUR	4.00E+00	LVG_GAP	#VALUE!	0.00064962	0.00159867	0.09389009	0.00050751	0.00068007	0.00558265	0.00466913	0.01471791	0.00695294	#VALUE!	5.7857E-05	0.00106578	0.01547918	0.00061917	0.00025376	0.00101503	0.02030056	0.08170975	
8760-HOUR	6.88E+00	OM_RVR	#VALUE!	0.00111837	0.00275223	0.16163901	0.00087372	0.00117079	0.00961097	0.00803826	0.02533801	0.01197002	#VALUE!	9.9605E-05	0.00183482	0.02664859	0.00106594	0.00043686	0.00174745	0.03494088	0.14066962	
8760-HOUR	6.79E+00	ATRM_EN	#VALUE!	0.00110228	0.00271265	0.15931462	0.00086116	0.00115395	0.00947276	0.00792267	0.02497364	0.01179789	#VALUE!	9.8172E-05	0.00180844	0.02626538	0.00105062	0.00043058	0.00172232	0.0344464	0.13864678	
8760-HOUR	4.44E+00	CBN_RDG	#VALUE!	0.00072192	0.00177659	0.10433928	0.000564	0.00075575	0.00620396	0.00518876	0.01635589	0.00772675	#VALUE!	6.4296E-05	0.00118439	0.01720188	0.00068808	0.000282	0.00112799	0.02255984	0.09080337	
8760-HOUR	3.84E+00	CR_HM_EN	#VALUE!	0.00062443	0.00153668	0.09024972	0.00048784	0.0006537	0.0053662662													

SSO		Air concentration of PAHs from diesel combustion (mg/m3)															
		Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indo(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
MPOI		4.64941E-06	9.16E-06	1.23E-06	6.16759E-07	2.37215E-07	1.0912E-06	5.69316E-07	2.37215E-07	1.51818E-06	3.32101E-07	3.98521E-06	1.26673E-05	4.26987E-07	0.00012857	4.04E-05	3.65E-06
Cabin		5.23281E-08	1.03E-07	1.39E-08	6.94148E-09	2.6698E-09	1.2281E-08	6.40752E-09	2.6698E-09	1.70867E-08	3.73772E-09	4.48526E-08	1.42567E-07	4.80564E-09	1.447E-06	4.55E-07	4.11E-08
Plateau		1.53644E-07	3.03E-07	4.08E-08	2.03814E-08	7.839E-09	3.6059E-08	1.88136E-08	7.839E-09	5.01696E-08	1.09746E-08	1.31695E-07	4.18603E-07	1.41102E-08	4.2487E-06	1.34E-06	1.21E-07
Alberta Ambient Air Quality Objective															0.003		
		Soil concentration															
dry dep rate	0.01																
wet dep rate	0.000000062																
CF s to year	31536000																
Dep total	MPOI	9.13718E-06	1.8E-05	2.42E-06	1.21207E-06	4.66183E-07	2.1444E-06	1.11884E-06	4.66183E-07	2.98357E-06	6.52656E-07	7.83187E-06	2.48941E-05	8.39129E-07	0.00025267	7.94E-05	7.18E-06
	Cabin	1.02837E-07	2.03E-07	2.73E-08	1.36416E-08	5.24678E-09	2.4135E-08	1.25923E-08	5.24678E-09	3.35794E-08	7.34549E-09	8.81458E-08	2.80178E-07	9.4442E-09	2.8438E-06	8.94E-07	8.08E-08
	Plateau	3.01947E-07	5.95E-07	8.01E-08	4.00542E-08	1.54055E-08	7.0865E-08	3.69731E-08	1.54055E-08	9.85949E-08	2.15676E-08	2.58812E-07	8.22651E-07	2.77298E-08	8.3498E-06	2.63E-06	2.37E-07
Zs0 (m)	0.02																
QB (kg/m3)	1500																
CF ug to mg	1.00E-03																
Dep SS	MPOI	3.05E-10	6.00E-10	8.08E-11	4.04E-11	1.55E-11	7.15E-11	3.73E-11	1.55E-11	9.95E-11	2.18E-11	2.61E-10	8.30E-10	2.80E-11	8.42E-09	2.65E-09	2.39E-10
	Cabin	3.43E-12	6.75E-12	9.09E-13	4.55E-13	1.75E-13	8.05E-13	4.20E-13	1.75E-13	1.12E-12	2.45E-13	2.94E-12	9.34E-12	3.15E-13	9.48E-11	2.98E-11	2.69E-12
	Plateau	1.01E-11	1.98E-11	2.67E-12	1.34E-12	5.14E-13	2.36E-12	1.23E-12	5.14E-13	3.29E-12	7.19E-13	8.63E-12	2.74E-11	9.24E-13	2.78E-10	8.75E-11	7.91E-12
Kt (yrs-1)	-5.16E-07																
tD (years)	5.00E+01																
		Surface Soil Concentration (mg/kg)															
	MPOI	5.90E-04	1.16E-03	1.57E-04	7.83E-05	3.01E-05	1.39E-04	7.23E-05	3.01E-05	1.93E-04	4.22E-05	5.06E-04	1.61E-03	5.42E-05	1.63E-02	5.13E-03	4.64E-04
	Cabin	6.64E-06	1.31E-05	1.76E-06	8.81E-07	3.39E-07	1.56E-06	8.13E-07	3.39E-07	2.17E-06	4.75E-07	5.69E-06	1.81E-05	6.10E-07	1.84E-04	5.78E-05	5.22E-06
	Plateau	1.95E-05	3.84E-05	5.17E-06	2.59E-06	9.95E-07	4.58E-06	2.39E-06	9.95E-07	6.37E-06	1.39E-06	1.67E-05	5.31E-05	1.79E-06	5.39E-04	1.70E-04	1.53E-05
CCME soil guidelines	Ag health			2.5	0.1	20	0		0.1		0.1	50		0.1	0.013	0.046	0.1
AB ag guidelines (Tier 1)		0.33		1.3								15.4	0.4		0.014	0.11	7.7

SO		Air concentration of PAHs from diesel combustion (mg/m3)															
		Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)anthracene	Fluoranthene	Fluorene	Indo(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
MPOI		2.32471E-05	4.58E-05	6.17E-06	3.0838E-06	1.18608E-06	5.4559E-06	2.84658E-06	1.18608E-06	7.59088E-06	1.66051E-06	1.99261E-05	6.33364E-05	2.13494E-06	0.00064285	0.000202	1.83E-05
Cabin		2.6164E-07	5.15E-07	6.94E-08	3.47074E-08	1.3349E-08	6.1405E-08	3.20376E-08	1.3349E-08	8.54336E-08	1.86886E-08	2.24263E-07	7.12837E-07	2.40282E-08	7.2352E-06	2.27E-06	2.06E-07
Plateau		7.68222E-07	1.51E-06	2.04E-07	1.01907E-07	3.9195E-08	1.803E-07	9.4068E-08	3.9195E-08	2.50848E-07	5.4873E-08	6.58476E-07	2.09301E-06	7.0551E-08	2.1244E-05	6.68E-06	6.04E-07
Alberta Ambient Air Quality Objective															0.003		

Appendix I. Exposure Factors

Forage	Units	Value
Plant-soil bioconcentration factor for forage/silage, or grain (Brforage)	unitless	COPC specific
Interception fraction of the edible portion of plant (Rp)		0.5
Plant surface loss coefficient (kp)	%	18
Length of plant exposure to deposition per harvest of edible portion of plant (Tp)	unitless	0.5
Yield or standing crop biomass of the edible portion of the plant (Yp)	year	0.24
Cattle (Heifer)	Units	Value
Soil Ingestion Rate	kg/d	0.5
Soil bioavailability factor	unitless	1
Inhalation Rate	m3/d	163.893
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (Fi)	unitless	0.5
Quantity of plant type (i) ingested by the animal per day (Qpi)	kg/d	31.25
Biotransfer factor for beef tissue (Babeef)	day/ kg	COPC specific
Biotransfer factor for beef milk (Bamilk)	day/ kg	COPC specific
Body Weight (adult cow)	kg	1250
Metabolism factor	unitless	1
Cattle (calf)		
Soil Ingestion Rate	kg/d	0.5
Soil bioavailability factor	unitless	1
Inhalation Rate	m3/d	78.743
Milk ingestion rate (10% body weight per day)	unitless	206.800
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (Fi)	kg/d	0.5
Quantity of plant type (i) ingested by the animal per day (Qpi)	unitless	7.81E+00
Body Weight (fall calf)	kg	5.00E+02
Metabolism factor	unitless	1
Human		
Rancher adult (>20years)		
Lifespan	years	80
Body Weight	kg	70.7
Soil Ingestion Rate	kg/d	0.00002
Inhalation Rate	m3/d	16.6
Beef Ingestion Rate	kg/d	0.00122
Rancher child (5-11)		
Body Weight	kg	32.9
Soil Ingestion Rate	kg/d	0.00008
Inhalation Rate	m3/d	14.5
Beef Ingestion Rate	kg/d	0.00075

Appendix J. Toxicity Profiles

Aluminum Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	---	Non-toxic to plants	EcoSSL 2003	Not available
Cattle (mammal)	mg/kg bw/d	1.93	---	Chronic LOAEL, Rat	US EPA 1999	
Human (all)		1	---	CNS neurotoxicity, developmental stage	US EPA PPRTV 2006	

Naturally, aluminum does not exist in a pure state. Aluminum complexes with water, chloride, fluoride, nitrate, sulfate, phosphate, humic materials and clay (Bodek et al., 1998), binding to suspended solids and sediments. The complex forms were more soluble than elemental aluminum. In more acidic soils ($\text{pH} \leq 5.5$), insoluble aluminum becomes soluble and therefore becomes more bioavailable, resulting in higher toxicity at low doses (US EPA, 2003).

Aluminum can be absorbed through the roots of plants. The main exposure routes for mammals were inhalation, ingestion, and dermal exposure. The subchronic NOAEL for terrestrial plants is 5 mg/kg. In rats, chronic aluminum exposure inhibited growth, setting the LOAEL of 1.93 mg/kg bw/d. No suitable toxicity data for human exposure was identified during a scientific literature review.

Antimony Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	---	---	---	20
Cattle (mammal)	mg/kg bw/d	0.059	0.27	Chronic LOAEL, Rat	EcoSSL 2005	Not available
Human (all)		0.0004	---	Hematologic	USEPA IRIS	

Antimony naturally tends to bind soil and particles containing iron, manganese or aluminum (Ainsworth, 1988). In soil, it is oxidized by bacterial. Plants can take up antimony from surface deposition or absorption through the roots, depending on the solubility within the soil. The appropriate dose for terrestrial plants is set at 5 mg/kg (US EPA, 1999).

In mammals, antimony exposure routes were ingestion and inhalation, distributing to the bone, kidney, liver, kidney, spleen and thalamus (Sunagawa 1981; Ainsworth 1988). In rats, the chronic LOAEL for mortality is 0.066 mg/kg bw/d. According to the US EPA, an acceptable dose of antimony to humans is 0.0004 mg/kg bw/d. Antimony toxicity in humans results in hematological effects.

Arsenic Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	18	LOAEL corn yield	EcoSSL 2005	17
Cattle (mammal)	mg/kg bw/d	1.04	46	Chronic NOAEL, dog	EcoSSL 2005	Not available
Human (all)		1.8	---	TRV, Bladder, lung, liver cancer	Health Canada, 2010	

Arsenic is usually found in both organic and inorganic (trivalent and pentavalent) forms. Depending on its physiochemical property, the toxicity profile varies. The trivalent is the most toxic, followed by the pentavalent and elemental arsenic is essential non-toxic (US EAP, 1999).

Due to arsenic's complex chemistry, the environmental fate of arsenic highly depends on the form and the surrounding compounds present. Inorganic arsenic tightly binds to organic matter, making it insoluble. Soluble arsenic dissolves in the water column or absorb to sediments. Thus, the bioavailability of arsenic and the organic clay content in the soil matrix were inversely proportional. Trivalent arsenic tends to accumulate in plant roots, causing toxicity to cell membranes.

Mammalian exposure to arsenic is predominantly through ingestion. Inorganic arsenic is more readily bioavailable and have greater absorption rates than organic (US EPA, 1999). Arsenic will travel throughout the body, targeting various organs, but is rapidly metabolized by the liver. The chosen chronic NOAEL for mammals is 1.25 mg/kg bw/d.

Herbivores have low arsenic biomagnification rate due to the lack of transport of arsenic to soil to plants. Carnivores have highest BM due to their diverse diets. In humans, arsenic toxicity can result n bladder, lung, liver cancer. Health Canada (2010) has set the human TDI for arsenic at 1.8 mg/kg bw/d.

Barium Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	---	---	---	750
Cattle (mammal)	mg/kg bw/d	51.8	2000	Chronic NOAEL, rat	EcoSSL 2005	
Human (all)		0.2	---	Renal lesions	Health Canada 2010, US EPA 2005	

Barium naturally occurs as barite (barium sulfate) or witherite (barium carbonate) (US EPA, 2005). The mobility and solubility of barium decreases in more basic soils, higher organic matter present, and the presence of metal oxides and hydroxides. Soluble barium were more mobile in the environment, can react with sulfates and carbonates in water (US EPA, 2005).

The chemical and physiological properties of barium were similar to calcium. Therefore barium toxicity can result in any process calcium is involved in. the toxic effect of barium in humans results in renal lesions, thus setting the tolerable daily intake at 0.2 mg/kg bw/d (Health Canada, 2010).

Beryllium Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	---	---	---	5
Cattle (mammal)	mg/kg bw/d	0.532	21	Chronic NOAEL, rat	EcoSSL 2005	
Human		0.002	---	Small intestine lesions	USEPA IRIS	

Naturally beryllium exists as beryllium oxide. Beryllium will bind to clay in low pH soil and precipitate into insoluble complexes in high pH soil (Callahan et al. 1979). Plants take up and concentrate soluble beryllium through their roots. The US EPA (1999) has adopted a dose of 0.1 mg/kg to be acceptable for terrestrial plants.

Through ingestion, beryllium is absorbed through the lungs and gastrointestinal tract and distributed to the liver, skeleton, tracheobronchial lymph nodes and blood. Toxicity to beryllium results in small intestine lesions. Chronic NOAEL in rats to beryllium is 0.002 mg/kg bw/d.

Cadmium Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	32	Chronic LOAEL	EcoSSL 2005	3.8
Cattle (mammal)	mg/kg bw/d	0.77	0.36	Chronic LOAEL, mouse	EcoSSL 2005	
Humans (all)		0.001	---	Renal tubular dysfunction	Health Canada 2010	

Cadmium can exist either in its elemental or valance state (2+) in the environment. The low vapour pressure of cadmium allows the metal to be released into the air from soil; however, remain unaffected in aquatic environments. Callahan et al. (1979) found that cadmium concentrations in sediments is greater than in the overlying water.

Mammals can be exposed to cadmium either through ingestion or inhalation. The exposure duration and retention to cadmium is inversely proportional to the absorption. Other metals, such as calcium

or iron, inversely affects the absorption of cadmium through ingestion (Friberg, 1979). Cadmium targets organs include the liver and kidneys. This can result in renal tubular dysfunction in humans. Elemental cadmium does not metabolize directly, instead the valence form binds to proteins in the body. Health Canada has set the total daily intake at 0.001 mg/kg bw/d.

Chromium (total) Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	---	---	---	64 (Total)
Cattle (mammal)	mg/kg bw/d	2.4	34 (CrIII)	NOAEL	EcoSSL 2008	
Humans (all)		0.001	---	hepatotoxicity	Health Canada 2010	

The most common forms of chromium naturally found were the trivalent and hexavalent states, both were insoluble with limited mobility through soil. Chromium 3+ is considered an essential element. Hexavalent chromium has a greater biomagnification and toxicity relative to trivalent chromium due to the long persistence in water, low membrane permeability and non corrosivity (Cary, 1982; ATSDR 1993).

Chromium exposure can occur through ingestion, inhalation or dermal absorption in mammals. Once absorbed, chromium will bind to ligands and reducing agents within the body, never truly metabolizing (US EPA, 1999). Chromium is a known hepatotoxin in humans. The oral tolerable daily intake for humans has been set at 0.001 mg/kg bw/d (Health Canada, 2010).

Cobalt Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	13	-	EcoSSL 2005	20
Cattle (mammal)	mg/kg bw/d	7.33	230	-	EcoSSL 2005	Not available
Human (all)		-	-	-	-	
adult		0.01		Thyroid dysfunction	US EPA PPRTV 2008	
child		0.0003				

In the environment, cobalt is naturally complexed with copper, nickel, manganese and arsenic (US EPA, 2005). Cobalt is an essential trace metal and a component of vitamin B12, involved in the growth and normal neural activity. Divalent cobalt is the most commonly found in soils, oxidizing to trivalent cobalt at low pH. The bioavailability of cobalt to terrestrial plants is highly dependent on the pH of the

soil; leaching and taken up by plants in more acidic soils and adsorbing to colloids at in more neutral soils.

Ruminant animals, such as cattle, can intake inorganic cobalt to meet their nutritional requirements, due to their gut microorganisms capacity to biosynthesize vitamin B12 (Henry, 1995). The toxic response of cobalt in humans results in polycythemia, cardiomyopathy and effects on the male reproductive system (Paternain et al., 1988; Haga et al., 1996, Pedigo and Vernon, 1993). The reported NOAEL in cattle for biochemical and growth effects is found 0.30 mg/kg/day (Maro et al., 1980).

Copper Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	70	Chronic LOAEL	EcoSSL 2007	63
Cattle (mammal)	mg/kg bw/d	5.6	49	LOAEL	EcoSSL 2007	Not available
Human		0.091	-	hepatotoxicity, gastrointestinal effects	Health Canada, 2010	
toddler			-		Health Canada 2010	
child		0.11	-			
adult		0.141	-			

Copper is an essential micronutrient. The most common state copper is found in is in +2 state. Copper +1 is unstable and oxidizes to copper +2. Copper adsorbs to soils and sediments and soils, forming complexes with organic material, humic substances and hydrous metals oxides; highly affecting its aquatic fate (Callahan et al. 1979). Elemental and complexed copper biotransformation or biodegradation or copper is low.

The main routes of exposure of copper in mammals in ingestion, inhalation and dermal exposure. Copper targets the liver but does not get metabolized. Instead, it binds to DNA to generate free radicals to induce hepatotoxicity and gastrointestinal effects (US EPA, 1985; Health Canada, 2010). In humans, the tolerable daily intake for humans ranges from 0.091 (toddlers) to 0.141 mg/kg bw/d (Health Canada, 2010).

Lead Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	120	12	LOAEL Senna	EcoSSL 2005	70
Cattle (mammal)	mg/kg bw/d	4.7	56	NOAEL	EcoSSL 2005	Not available
Human (all)		5 (ug/dL BBL)	-	Neurological disorders, decreased IQ	Health Canada, 2013	

In soil, soluble lead will convert to sulfate or phosphate derivatives or complex with organic matter and clay, making it immobile. The bioavailability of lead is greatest in acidic sandy soils (NRCC, 1978). Terrestrial plant uptake of lead depends on organic matter and calcium content, metal concentration, precipitation, temperature and light.

Although blood lead levels of Canadians have declined significantly over the past 30 years, there is new scientific evidence that health effects were occurring below the current Canadian blood lead intervention level of 10 µg/dL. There is sufficient evidence that BLLs below 5 µg/dL were associated with adverse health effects. Health effects have been associated with BLLs as low as 1-2 µg/dL, levels which were present in Canadians, although there is uncertainty associated with effects observed at these levels. While Canadian BLLs were among the lowest in the world, it is considered appropriate to apply a conservative approach when characterizing risk. Accordingly, additional measures to further reduce lead exposures to Canadians were warranted. Therefore, an acceptable BLL of 5 µg/dL was adopted.

Manganese Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	220		EcoSSL 2007	-
Cattle (mammal)	mg/kg bw/d	51.5	4000	NOAEL	EcoSSL 2007	-
Human:		0.136	-	Parkinson like neurological disorders	Health Canada 2010	Not available
Toddler			-			
Youth		0.122	-			
Adult		0.156	-			

Manganese is a multi-valent metal, that predominantly occurs in the environment in 2+, 3+ and 4+ valence states. In the presence of organic matter and microorganism, manganese undergoes reduction into 2+ compounds, making it more soluble. The opposite occurs in aerobic conditions. In lower pH soils, the solubility of manganese increases. This essential nutrient is needed for growth, function in the central nervous system and reproductive function in mammals. In plants, manganese is required in the oxidation-reduction process.

The exposure routes of manganese were inhalation, dermal absorption, and predominantly oral ingestion. It widely distributes to all tissues in the body and potentially crosses placental and blood-brain barriers. Chronic exposure can lead to accumulation in the brain, resulting in Parkinson like neurological disorders (Health Canada, 2010). The reference dose assigned to manganese in humans is 0.122 to 0.156 mg/kg bw/d (Health Canada, 2010).

Mercury Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most	Source	Alberta Provincial

				sensitive species		Soil Guideline
Terrestrial Plants	mg/kg	---	---	---	---	12
Cattle (mammal)	mg/kg bw/d	1	-	NOAEL	Mayfield and Fairbrother, 2012	Not available
Humans (all)		0.0003	-	Kidney disorders	Health Canada 2010	

Mercury exists in the environment in inorganic and organic forms, having three valence states (0+, 1+ and 2+). In organic mercury often converts to organomercury compounds. In is highly toxic in all forms, however methyl mercury, is the most toxic.

In terrestrial plants, mercury inhibit protein synthesis and affect water adsorbing and transporting mechanisms in plants (Adriano 1986). In mammals, mercury can be readily absorbed, inhaled and ingested. Once in mammals, mercury bioaccumulates in the kidney and will biomagnify (Rothstein and Hayes 1964; Nielsen and Andersen 1991). All mercury compounds interferes with metabolism and the central nervous system can be irrevocably damaged by methyl mercury, resulting in Mad Hatter's disease. The tolerable daily intake for mercury is 0.0003 mg/kg bw/d (Health Canada, 2010).

Molybdenum Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	-	-	-	-	4
Cattle (mammal)	mg/kg bw/d	-	-	-	-	Not available
Human		23	-	Reproductive effects	Health Canada 2010	
toddler			-			
child		23	-			
adult		28	-			

Molybdenum is a naturally occurring micronutrient in plants and animals and exists in several variance states. It is released into the air through industrial processes and deposits to the surrounding environment. However, the molybdenum found in sediments and soil is predominantly from water sources (ATSDR, 2020).

Exposure to molybdenum occurs through ingestion and inhalation and targets various organs in mammals, including lungs, liver, kidney, and bone (ASTDR, 2020). Molybdenum toxicity can have respiratory, hepatic, renal, reproductive, developmental and uric acid level effects. It is also a known carcinogen. The adopted tolerable daily intake for adults is set at 28 mg/kg bw/d (Health Canada, 2010).

Nickel Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most	Source	Alberta Provincial

				sensitive species		Soil Guideline
Terrestrial Plants	mg/kg	---	38	Chronic NOAEL Bush bean	EcoSSL 2007	45
Cattle (mammal)	mg/kg bw/d	1.7	130	LOAEL	EcoSSL 2007	Not available
Humans (all)		0.011	-	Post implantation perinatal mortality (increased fetus loss), respiratory tract lesions	Health Canada 2010	

Selenium Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	---	0.52	Subchronic NOAEL	EcoSSL 2007	1
Cattle (mammal)	mg/kg bw/d	0.143	0.63	Chronic LOAEL, mouse	EcoSSL 2007	Not available
Human (all)		5.5 - 6.2	-	selenosis	Health Canada 2010	
Toddler			-			
Youth		6.3	-			
Adult and elder		5.7	-			

Selenium is a naturally occurring micronutrient, mostly found combined with other metals. Its most common oxidations states were -2, 0, +4 (selenites), and +6 (selenates), which alters the toxicity depending to the ambient condition of the media it is found in. Elemental selenium and selenium sulfides were both relatively immobile in the environment.

Selenium is essential in protection against oxidative stress in mammals. Exposure to selenium includes inhalation (usually of elemental selenium dust), dermal contact (result in rashes, swelling and pain ((ASTDR, 2003), or ingestion. Chronic selenium intoxication and result in selenosis, which is defined by neurotoxic effects, fatigue and hair and nail damage (ASTDR, 2003). Health Canada has accepted 5.7 mg/kg bw/d as the tolerable daily intake in adult humans.

Thallium Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most	Source	Alberta Provincial

				sensitive species		Soil Guideline
Terrestrial Plants	mg/kg	---	---	---	---	1
Cattle (mammal)	mg/kg bw/d	0.0131	-	Subchronic LOAEL, rat	US EPA 1999	Not available
Human (all)		0.00001	-	Alopecia, hair follicle atrophy	US EPA IRIS and TDI (1986, 2009) – salts, withdrawn	

Naturally thallium can exist in a monovalent (thallous) or trivalent (thallic) state (US EPA, 1999). Due to its high reactivity with air and moisture, it oxidizes in the air (Standen 1967). Thallium is insoluble to water and adsorbs to sediments.

Ingestion is the primary route of exposure to thallium for mammals. It distributes to the skin, liver, and muscle, predominantly in the kidneys (Downs et al. 1960; Manzo et al. 1983) and is known to cross the placental barrier and induce fetal toxicity (Gibson and Becker 1970). In rats, the subchronic LOAEL was reported at 0.0131 mg/kg bw/d (US EPA, 1999). No suitable toxicity data for human exposure was identified during a scientific literature review.

Uranium Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	-	-	-	-	33
Cattle (mammal)	mg/kg bw/d	-	-	-	-	Not available
Human (all)		0.0006	-	nephrotoxic, hepatotoxic	Health Canada 2010	

Uranium is a naturally occurring radioactive elemental that is a mixture of three isotopes. It is present in all rocks and soils. Uranium is not taken up by plants but adsorbs onto roots, therefore were found in high abundance in root vegetables (ASTDR, 2013).

The predominant route of exposure to uranium is ingestion of food or drinking water. Inhalation is much lower, however, it is a source for workers who mine, mill or process uranium (ASTDR, 2013). Ingestion of natural uranium can lead to nephrotoxicity and hepatotoxicity. The respiratory tract is affected during inhalation. Other potential target organs also include reproductive system and developing organisms. Therefore, 0.0006 mg/kg bw/d (Health Canada, 2010) is implemented.

Vanadium Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline

Terrestrial Plants	mg/kg	-	-	-	-	130
Cattle (mammal)		4.16	280	-	EcoSSL 2005	
Human (all)	mg/kg bw/d	1.8	-	Kidney	National Academy of Sciences (2001)	Not available

Vanadium is a naturally occurring element abundantly found in various minerals. Vanadium particles in the air tend to deposit to the soil, where it will partition or bind to other particles. In water, vanadium can either dissolve or adsorb to particulate matter (ASTDR, 2012).

Ingestion of food, especially seafood, is the main source vanadium to humans. Individuals who smoke were exposed to higher than background levels of vanadium. Toxicity of vanadium through oral ingestion can result in nausea, diarrhea, stomach cramps (ASTDR, 2013), however, no suitable toxicity data for human exposure was identified during a scientific literature review.

Zinc Human and Ecological Toxicity Assessment							
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline	
Terrestrial Plants	mg/kg	---	160	Chronic LOAEL	EcoSSL 2007	250	
Cattle (mammal)	mg/kg bw/d	75.4	79	LOAEL	EcoSSL 2007	Not available	
Human (all)		0.49	-	increased growth, reduced iron and copper status	Health Canada 2010		
Toddler			-				
Youth			0.54				-
Adult and elder			0.57				-

Carcinogenic PAHs (Benzo(a)pyrene) Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most sensitive species	Source	Alberta Provincial Soil Guideline
Terrestrial Plants	mg/kg	-	-	-	-	0.6
Cattle (mammal)	mg/kg bw/d	0.615	1.1	NOAEL	EcoSSL 2007	Not available
Humans (all)		2.3	-	Gastric tumours, cancer	Health Canada 2010	

Non-carcinogenic PAHs (Naphthalene) Human and Ecological Toxicity Assessment						
Receptor	Units	TRV	Soil Guideline	Toxicological Endpoint/ most	Source	Alberta Provincial

				sensitive species		Soil Guideline
Terrestrial Plants	mg/kg	-	-	-	-	0.017
Cattle (mammal)	mg/kg bw/d	65.5	100	NOAEL	EcoSSL 2007	Not available
Humans (all)		0.02	-	Decreased body weight	Health Canada, 2010	

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Appendix K. Predicted Hourly, Daily and Monthly Ground Level Concentrations.

PM2.5 - Concentration: [ug/m ³]							
Average Period	100th Percentile (1st Highest)	1-hour 99.9th Percentile (9th Highest)	24-hour 98th Percentile	Average	X [km]	Y [km]	Receptor ID
Max							
1-HOUR	664.39	567.56	-	24.82	678.0	5518	644
8-Hour	-	-	-	-			
24-HOUR	205.90	-	114.82	-	678.0	5518	644
8760-HOUR	47.44	-	-	-	679.0	5519.0	716
Sensitive							
1-HOUR	2.05E+00	1.61E+00	-	0.00E+00	690.1	5588.0	CARTWRT
1-HOUR	7.73E+00	3.49E+00	-	8.41E-02	696.4	5548.3	CHIMNEY
1-HOUR	2.85E+00	1.84E+00	-	0.00E+00	695.8	5573.6	BB_RANCH
1-HOUR	1.62E+01	1.05E+01	-	7.09E-03	685.3	5523.3	RH_CRK
1-HOUR	3.76E+00	2.54E+00	-	0.00E+00	672.4	5573.6	CTRT_CRK
1-HOUR	1.58E+01	7.32E+00	-	0.00E+00	672.8	5547.1	OLDM_RF
1-HOUR	2.07E+01	1.39E+01	-	3.22E-01	683.1	5552.9	LVST_F
1-HOUR	2.42E+01	1.36E+01	-	0.00E+00	683.4	5556.6	PLT_MC
1-HOUR	2.84E+00	1.85E+00	-	0.00E+00	695.8	5573.6	C_GARDN
1-HOUR	2.53E+00	1.89E+00	-	0.00E+00	696.7	5576.4	S_GARDN
1-HOUR	2.42E+00	2.01E+00	-	7.77E-10	700.6	5565.0	RLND_MB
1-HOUR	5.48E+00	2.59E+00	-	3.41E-02	694.7	5555.1	R_BLAKE
1-HOUR	4.51E+00	2.62E+00	-	8.43E-03	693.2	5556.8	B_RANSOM
1-HOUR	4.88E+00	2.34E+00	-	3.05E-02	699.4	5555.2	RCKP_PLC
1-HOUR	7.38E+00	3.16E+00	-	7.84E-02	697.4	5548.7	S_HARVEY
1-HOUR	6.19E+00	2.88E+00	-	6.76E-02	697.6	5550.6	R_DAVIS
1-HOUR	6.76E+00	3.12E+00	-	7.09E-02	696.5	5549.3	RESIDEN
1-HOUR	6.73E+00	3.07E+00	-	7.06E-02	696.8	5549.5	COCHLAN
1-HOUR	1.90E+01	1.42E+01	-	2.12E-01	683.8	5544.9	N_RCKP
1-HOUR	1.15E+01	5.21E+00	-	0.00E+00	671.4	5550.3	NW_RCKP
1-HOUR	1.85E+01	1.27E+01	-	7.52E-02	686.7	5535.8	S_RCKP
1-HOUR	1.34E+01	6.00E+00	-	1.85E-01	695.4	5543.1	E_RCKP
1-HOUR	2.12E+01	1.09E+01	-	0.00E+00	676.7	5540.5	W_RCKP
1-HOUR	8.38E+00	3.87E+00	-	4.52E-02	705.0	5535.6	WLDRN_N
1-HOUR	6.85E+00	4.23E+00	-	9.03E-02	705.9	5523.4	WLDRN_S
1-HOUR	9.04E+00	5.44E+00	-	2.77E-02	697.2	5528.8	BOB_BNB
1-HOUR	2.27E+00	1.50E+00	-	0.00E+00	705.0	5580.9	BLADE_R
1-HOUR	1.08E+01	8.32E+00	-	3.87E-03	687.9	5528.5	LVG_GAP
1-HOUR	1.62E+01	1.21E+01	-	1.19E-01	683.8	5536.1	OM_RVR
1-HOUR	1.44E+01	1.04E+01	-	1.17E-01	682.4	5537.3	ATRM_EN
1-HOUR	1.18E+01	8.09E+00	-	4.00E-02	679.9	5540.0	CBN_RDG
1-HOUR	1.02E+01	6.74E+00	-	0.00E+00	676.2	5544.3	CR_HM_EN
1-HOUR	1.52E+01	6.69E+00	-	0.00E+00	675.0	5545.1	HNYMNCRK
1-HOUR	3.09E+01	1.51E+01	-	1.70E-01	685.8	5539.1	BLADE_C
1-HOUR	2.97E+01	1.47E+01	-	1.70E-01	686.0	5539.1	MCLY_CRK
1-HOUR	9.38E+00	5.65E+00	-	6.53E-02	696.5	5525.0	DENNIS
1-HOUR	1.43E+01	9.66E+00	-	2.21E-01	687.5	5551.0	PLT_NE
1-HOUR	9.57E+00	6.14E+00	-	0.00E+00	679.1	5564.1	PLT_NW
1-HOUR	3.31E+01	2.24E+01	-	9.50E-01	681.9	5545.5	PLT_SW
1-HOUR	2.63E+01	1.47E+01	-	2.07E-01	687.3	5545.7	PLT_SE
1-HOUR	7.53E+00	3.08E+00	-	9.43E-02	698.3	5548.5	RCKP_E
1-HOUR	3.46E+00	2.59E+00	-	0.00E+00	672.1	5577.0	RCKP_NE
1-HOUR	2.24E+00	1.29E+00	-	0.00E+00	659.4	5576.5	RCKP_NW
1-HOUR	5.93E+01	3.65E+01	-	0.00E+00	673.2	5534.9	RCKP_SW
1-HOUR	7.85E+00	4.64E+00	-	6.99E-02	699.6	5536.4	RCKP_SE
1-HOUR	2.39E+00	1.70E+00	-	0.00E+00	714.5	5579.1	PLATEAU
1-HOUR	9.95E+00	5.89E+00	-	2.36E-01	693.4	5519.2	AP
1-HOUR	8.73E+00	5.53E+00	-	6.78E-02	693.4	5515.3	CABIN
1-HOUR	6.87E+01	5.87E+01	-	1.31E-01	685.0	5514.3	R2
1-HOUR	8.73E+00	5.53E+00	-	6.78E-02	693.4	5515.3	R5
1-HOUR	2.03E+01	1.50E+01	-	1.10E-01	687.7	5510.2	R11

PM2.5 - Concentration: [ug/m**3]							
Average Period	100th Percentile (1st Highest)	1-hour 99.9th Percentile (9th Highest)	24-hour 98th Percentile	Average	X [km]	Y [km]	Receptor ID
Max							
1-HOUR	664.39	567.56	-	24.82	678.0	5518	644
8-Hour	-	-	-	-			
24-HOUR	205.90	-	114.82	-	678.0	5518	644
8760-HOUR	47.44	-	-	-	679.0	5519.0	716
Sensitive							
24-HOUR	6.47E-01	-	3.16E-01	-	690.1	5588.0	CARTWRT
24-HOUR	1.45E+00	-	5.07E-01	-	696.4	5548.3	CHIMNEY
24-HOUR	8.98E-01	-	3.69E-01	-	695.8	5573.6	BB_RANCH
24-HOUR	4.37E+00	-	1.65E+00	-	685.3	5523.3	RH_CRK
24-HOUR	1.10E+00	-	4.12E-01	-	672.4	5573.6	CTRT_CRK
24-HOUR	2.52E+00	-	1.36E+00	-	672.8	5547.1	OLDM_RF
24-HOUR	4.88E+00	-	2.72E+00	-	683.1	5552.9	LVST_F
24-HOUR	4.41E+00	-	2.63E+00	-	683.4	5556.6	PLT_MC
24-HOUR	8.99E-01	-	3.68E-01	-	695.8	5573.6	C_GARDN
24-HOUR	9.01E-01	-	3.26E-01	-	696.7	5576.4	S_GARDN
24-HOUR	8.30E-01	-	3.00E-01	-	700.6	5565.0	RLND_MB
24-HOUR	1.51E+00	-	4.61E-01	-	694.7	5555.1	R_BLAKE
24-HOUR	1.57E+00	-	4.87E-01	-	693.2	5556.8	B_RANSOM
24-HOUR	1.32E+00	-	3.89E-01	-	699.4	5555.2	RCKP_PLC
24-HOUR	1.37E+00	-	4.97E-01	-	697.4	5548.7	S_HARVEY
24-HOUR	1.41E+00	-	4.39E-01	-	697.6	5550.6	R_DAVIS
24-HOUR	1.48E+00	-	4.57E-01	-	696.5	5549.3	RESIDEN
24-HOUR	1.45E+00	-	4.57E-01	-	696.8	5549.5	COCHLAN
24-HOUR	5.21E+00	-	2.52E+00	-	683.8	5544.9	N_RCKP
24-HOUR	1.77E+00	-	1.07E+00	-	671.4	5550.3	NW_RCKP
24-HOUR	4.43E+00	-	1.92E+00	-	686.7	5535.8	S_RCKP
24-HOUR	2.27E+00	-	1.11E+00	-	695.4	5543.1	E_RCKP
24-HOUR	3.33E+00	-	2.20E+00	-	676.7	5540.5	W_RCKP
24-HOUR	1.26E+00	-	5.28E-01	-	705.0	5535.6	WLDRN_N
24-HOUR	1.67E+00	-	6.52E-01	-	705.9	5523.4	WLDRN_S
24-HOUR	2.42E+00	-	8.02E-01	-	697.2	5528.8	BOB_BNB
24-HOUR	6.98E-01	-	2.45E-01	-	705.0	5580.9	BLADE_R
24-HOUR	3.85E+00	-	1.25E+00	-	687.9	5528.5	LVG_GAP
24-HOUR	4.05E+00	-	1.66E+00	-	683.8	5536.1	OM_RVR
24-HOUR	3.70E+00	-	1.47E+00	-	682.4	5537.3	ATRM_EN
24-HOUR	2.94E+00	-	1.29E+00	-	679.9	5540.0	CBN_RDG
24-HOUR	3.46E+00	-	1.19E+00	-	676.2	5544.3	CR_HM_EN
24-HOUR	3.55E+00	-	1.39E+00	-	675.0	5545.1	HNVMNCRK
24-HOUR	4.75E+00	-	2.10E+00	-	685.8	5539.1	BLADE_C
24-HOUR	4.77E+00	-	2.01E+00	-	686.0	5539.1	MCLY_CRK
24-HOUR	2.60E+00	-	8.16E-01	-	696.5	5525.0	DENNIS
24-HOUR	3.08E+00	-	1.59E+00	-	687.5	5551.0	PLT_NE
24-HOUR	2.28E+00	-	1.45E+00	-	679.1	5564.1	PLT_NW
24-HOUR	9.68E+00	-	5.87E+00	-	681.9	5545.5	PLT_SW
24-HOUR	5.32E+00	-	1.87E+00	-	687.3	5545.7	PLT_SE
24-HOUR	1.29E+00	-	5.59E-01	-	698.3	5548.5	RCKP_E
24-HOUR	1.23E+00	-	3.79E-01	-	672.1	5577.0	RCKP_NE
24-HOUR	7.71E-01	-	2.30E-01	-	659.4	5576.5	RCKP_NW
24-HOUR	8.57E+00	-	6.40E+00	-	673.2	5534.9	RCKP_SW
24-HOUR	1.84E+00	-	7.05E-01	-	699.6	5536.4	RCKP_SE
24-HOUR	4.26E-01	-	2.44E-01	-	714.5	5579.1	PLATEAU
24-HOUR	2.50E+00	-	1.03E+00	-	693.4	5519.2	AP
24-HOUR	2.50E+00	-	9.30E-01	-	693.4	5515.3	CABIN
24-HOUR	2.56E+01	-	1.34E+01	-	685.0	5514.3	R2
24-HOUR	2.50E+00	-	9.30E-01	-	693.4	5515.3	R5
24-HOUR	5.04E+00	-	2.72E+00	-	687.7	5510.2	R11

PM2.5 - Concentration: [ug/m**3]							
Average Period	100th Percentile (1st Highest)	1-hour 99.9th Percentile (9th Highest)	24-hour 98th Percentile	Average	X [km]	Y [km]	Receptor ID
Max							
1-HOUR	664.39	567.56	-	24.82	678.0	5518	644
8-Hour	-	-	-	-			
24-HOUR	205.90	-	114.82	-	678.0	5518	644
8760-HOUR	47.44	-	-	-	679.0	5519.0	716
Sensitive							
8760-HOUR	3.65E-02	-		-	690.1	5588.0	CARTWRT
8760-HOUR	1.66E-01	-		-	696.4	5548.3	CHIMNEY
8760-HOUR	4.80E-02	-		-	695.8	5573.6	BB_RANCH
8760-HOUR	2.91E-01	-		-	685.3	5523.3	RH_CRK
8760-HOUR	4.52E-02	-		-	672.4	5573.6	CTRT_CRK
8760-HOUR	1.82E-01	-		-	672.8	5547.1	OLDM_RF
8760-HOUR	7.30E-01	-		-	683.1	5552.9	LVST_F
8760-HOUR	3.38E-01	-		-	683.4	5556.6	PLT_MC
8760-HOUR	4.80E-02	-		-	695.8	5573.6	C_GARDN
8760-HOUR	4.44E-02	-		-	696.7	5576.4	S_GARDN
8760-HOUR	6.23E-02	-		-	700.6	5565.0	RLND_MB
8760-HOUR	1.25E-01	-		-	694.7	5555.1	R_BLAKE
8760-HOUR	1.21E-01	-		-	693.2	5556.8	B_RANSOM
8760-HOUR	1.09E-01	-		-	699.4	5555.2	RCKP_PLC
8760-HOUR	1.57E-01	-		-	697.4	5548.7	S_HARVEY
8760-HOUR	1.41E-01	-		-	697.6	5550.6	R_DAVIS
8760-HOUR	1.48E-01	-		-	696.5	5549.3	RESIDEN
8760-HOUR	1.47E-01	-		-	696.8	5549.5	COCHLAN
8760-HOUR	5.86E-01	-		-	683.8	5544.9	N_RCKP
8760-HOUR	1.37E-01	-		-	671.4	5550.3	NW_RCKP
8760-HOUR	3.22E-01	-		-	686.7	5535.8	S_RCKP
8760-HOUR	4.03E-01	-		-	695.4	5543.1	E_RCKP
8760-HOUR	3.54E-01	-		-	676.7	5540.5	W_RCKP
8760-HOUR	1.46E-01	-		-	705.0	5535.6	WLDRN_N
8760-HOUR	1.92E-01	-		-	705.9	5523.4	WLDRN_S
8760-HOUR	1.89E-01	-		-	697.2	5528.8	BOB_BNB
8760-HOUR	3.78E-02	-		-	705.0	5580.9	BLADE_R
8760-HOUR	2.59E-01	-		-	687.9	5528.5	LVG_GAP
8760-HOUR	3.53E-01	-		-	683.8	5536.1	OM_RVR
8760-HOUR	3.60E-01	-		-	682.4	5537.3	ATRM_EN
8760-HOUR	2.80E-01	-		-	679.9	5540.0	CBN_RDG
8760-HOUR	2.23E-01	-		-	676.2	5544.3	CR_HM_EN
8760-HOUR	2.16E-01	-		-	675.0	5545.1	HNYMNCRK
8760-HOUR	5.34E-01	-		-	685.8	5539.1	BLADE_C
8760-HOUR	5.28E-01	-		-	686.0	5539.1	MCLY_CRK
8760-HOUR	2.23E-01	-		-	696.5	5525.0	DENNIS
8760-HOUR	5.39E-01	-		-	687.5	5551.0	PLT_NE
8760-HOUR	1.25E-01	-		-	679.1	5564.1	PLT_NW
8760-HOUR	1.57E+00	-		-	681.9	5545.5	PLT_SW
8760-HOUR	5.76E-01	-		-	687.3	5545.7	PLT_SE
8760-HOUR	1.76E-01	-		-	698.3	5548.5	RCKP_E
8760-HOUR	4.20E-02	-		-	672.1	5577.0	RCKP_NE
8760-HOUR	2.49E-02	-		-	659.4	5576.5	RCKP_NW
8760-HOUR	1.08E+00	-		-	673.2	5534.9	RCKP_SW
8760-HOUR	2.00E-01	-		-	699.6	5536.4	RCKP_SE
8760-HOUR	4.13E-02	-		-	714.5	5579.1	PLATEAU
8760-HOUR	4.00E-01	-		-	693.4	5519.2	AP
8760-HOUR	2.99E-01	-		-	693.4	5515.3	CABIN
8760-HOUR	1.72E+00	-		-	685.0	5514.3	R2
8760-HOUR	2.99E-01	-		-	693.4	5515.3	R5
8760-HOUR	6.88E-01	-		-	687.7	5510.2	R11

PM10 - Concentration: [ug/m**3]						
Average Period	100th Percentile (1st Highest)	99.9th Percentile (9th Highest)	50th Percentile (average)	X [km]	Y [km]	Receptor ID
Max						
1-HOUR	2566.30	2212.30	97.68	678.0	5518	644
24-HOUR	772.88	-	-	678.0	5518	644
8760-HOUR	185.92	-	-	679.0	5519	716
Sensitive						
1-HOUR	6.48E+00	3.77E+00	0.00E+00	690.1	5588.0	CARTWRT
1-HOUR	1.25E+01	8.23E+00	1.88E-01	696.4	5548.3	CHIMNEY
1-HOUR	9.28E+00	4.50E+00	0.00E+00	695.8	5573.6	BB_RANCH
1-HOUR	5.41E+01	3.06E+01	1.66E-02	685.3	5523.3	RH_CRK
1-HOUR	7.37E+00	5.23E+00	0.00E+00	672.4	5573.6	CTRT_CRK
1-HOUR	2.80E+01	1.80E+01	0.00E+00	672.8	5547.1	OLDM_RF
1-HOUR	7.50E+01	4.07E+01	8.27E-01	683.1	5552.9	LVST_F
1-HOUR	6.66E+01	3.60E+01	0.00E+00	683.4	5556.6	PLT_MC
1-HOUR	9.25E+00	4.51E+00	0.00E+00	695.8	5573.6	C_GARDN
1-HOUR	7.93E+00	4.32E+00	0.00E+00	696.7	5576.4	S_GARDN
1-HOUR	7.63E+00	4.14E+00	2.10E-09	700.6	5565.0	RLND_MB
1-HOUR	1.21E+01	6.92E+00	7.30E-02	694.7	5555.1	R_BLAKE
1-HOUR	1.31E+01	7.63E+00	1.73E-02	693.2	5556.8	B_RANSOM
1-HOUR	9.38E+00	5.63E+00	6.49E-02	699.4	5555.2	RCKP_PLC
1-HOUR	1.16E+01	7.65E+00	1.74E-01	697.4	5548.7	S_HARVEY
1-HOUR	9.41E+00	7.60E+00	1.52E-01	697.6	5550.6	R_DAVIS
1-HOUR	1.06E+01	8.61E+00	1.61E-01	696.5	5549.3	RESIDEN
1-HOUR	1.04E+01	8.40E+00	1.60E-01	696.8	5549.5	COCHLAN
1-HOUR	4.98E+01	3.16E+01	6.14E-01	683.8	5544.9	N_RCKP
1-HOUR	2.05E+01	1.16E+01	0.00E+00	671.4	5550.3	NW_RCKP
1-HOUR	4.69E+01	2.53E+01	2.05E-01	686.7	5535.8	S_RCKP
1-HOUR	2.34E+01	1.52E+01	4.30E-01	695.4	5543.1	E_RCKP
1-HOUR	6.38E+01	3.36E+01	0.00E+00	676.7	5540.5	W_RCKP
1-HOUR	1.29E+01	7.48E+00	1.05E-01	705.0	5535.6	WLDRN_N
1-HOUR	1.32E+01	7.07E+00	2.22E-01	705.9	5523.4	WLDRN_S
1-HOUR	1.84E+01	1.10E+01	7.32E-02	697.2	5528.8	BOB_BNB
1-HOUR	5.62E+00	2.70E+00	0.00E+00	705.0	5580.9	BLADE_R
1-HOUR	2.19E+01	1.61E+01	1.05E-02	687.9	5528.5	LVG_GAP
1-HOUR	4.45E+01	1.94E+01	3.33E-01	683.8	5536.1	OM_RVR
1-HOUR	4.10E+01	2.18E+01	3.15E-01	682.4	5537.3	ATRM_EN
1-HOUR	3.31E+01	1.41E+01	9.76E-02	679.9	5540.0	CBN_RDG
1-HOUR	3.47E+01	1.85E+01	0.00E+00	676.2	5544.3	CR_HM_EN
1-HOUR	3.05E+01	1.83E+01	0.00E+00	675.0	5545.1	HNVMNCRK
1-HOUR	1.12E+02	3.98E+01	4.76E-01	685.8	5539.1	BLADE_C
1-HOUR	1.08E+02	4.00E+01	4.79E-01	686.0	5539.1	MCLY_CRK
1-HOUR	1.88E+01	1.02E+01	1.67E-01	696.5	5525.0	DENNIS
1-HOUR	3.26E+01	2.72E+01	5.71E-01	687.5	5551.0	PLT_NE
1-HOUR	1.87E+01	1.28E+01	0.00E+00	679.1	5564.1	PLT_NW
1-HOUR	9.68E+01	7.22E+01	2.81E+00	681.9	5545.5	PLT_SW
1-HOUR	3.86E+01	2.96E+01	5.60E-01	687.3	5545.7	PLT_SE
1-HOUR	1.23E+01	7.06E+00	2.04E-01	698.3	5548.5	RCKP_E
1-HOUR	7.00E+00	5.38E+00	0.00E+00	672.1	5577.0	RCKP_NE
1-HOUR	4.04E+00	3.16E+00	0.00E+00	659.4	5576.5	RCKP_NW
1-HOUR	2.07E+02	1.22E+02	0.00E+00	673.2	5534.9	RCKP_SW
1-HOUR	2.00E+01	9.08E+00	1.65E-01	699.6	5536.4	RCKP_SE
1-HOUR	5.53E+00	2.97E+00	0.00E+00	714.5	5579.1	PLATEAU
1-HOUR	1.44E+01	1.10E+01	6.36E-01	693.4	5519.2	AP
1-HOUR	1.71E+01	1.22E+01	1.76E-01	693.4	5515.3	CABIN
1-HOUR	2.61E+02	2.26E+02	1.15E+00	685.0	5514.3	R2
1-HOUR	1.71E+01	1.22E+01	1.76E-01	693.4	5515.3	R5
1-HOUR	4.99E+01	4.10E+01	2.44E-01	687.7	5510.2	R11

PM10 - Concentration: [ug/m**3]						
Average Period	100th Percentile (1st Highest)	99.9th Percentile (9th Highest)	50th Percentile (average)	X [km]	Y [km]	Receptor ID
Max						
1-HOUR	2566.30	2212.30	97.68	678.0	5518	644
24-HOUR	772.88	-	-	678.0	5518	644
8760-HOUR	185.92	-	-	679.0	5519	716
Sensitive						
24-HOUR	1.40E+00	-	-	690.1	5588.0	CARTWRT
24-HOUR	2.52E+00	-	-	696.4	5548.3	CHIMNEY
24-HOUR	2.11E+00	-	-	695.8	5573.6	BB_RANCH
24-HOUR	1.07E+01	-	-	685.3	5523.3	RH_CRK
24-HOUR	2.86E+00	-	-	672.4	5573.6	CTRT_CRK
24-HOUR	5.91E+00	-	-	672.8	5547.1	OLDM_RF
24-HOUR	1.36E+01	-	-	683.1	5552.9	LVST_F
24-HOUR	1.14E+01	-	-	683.4	5556.6	PLT_MC
24-HOUR	2.11E+00	-	-	695.8	5573.6	C_GARDN
24-HOUR	1.95E+00	-	-	696.7	5576.4	S_GARDN
24-HOUR	2.02E+00	-	-	700.6	5565.0	RLND_MB
24-HOUR	2.67E+00	-	-	694.7	5555.1	R_BLAKE
24-HOUR	2.82E+00	-	-	693.2	5556.8	B_RANSOM
24-HOUR	2.01E+00	-	-	699.4	5555.2	RCKP_PLC
24-HOUR	2.32E+00	-	-	697.4	5548.7	S_HARVEY
24-HOUR	2.36E+00	-	-	697.6	5550.6	R_DAVIS
24-HOUR	2.58E+00	-	-	696.5	5549.3	RESIDEN
24-HOUR	2.50E+00	-	-	696.8	5549.5	COCHLAN
24-HOUR	1.27E+01	-	-	683.8	5544.9	N_RCKP
24-HOUR	4.28E+00	-	-	671.4	5550.3	NW_RCKP
24-HOUR	7.11E+00	-	-	686.7	5535.8	S_RCKP
24-HOUR	3.70E+00	-	-	695.4	5543.1	E_RCKP
24-HOUR	9.67E+00	-	-	676.7	5540.5	W_RCKP
24-HOUR	2.40E+00	-	-	705.0	5535.6	WLDRN_N
24-HOUR	2.87E+00	-	-	705.9	5523.4	WLDRN_S
24-HOUR	3.74E+00	-	-	697.2	5528.8	BOB_BNB
24-HOUR	1.45E+00	-	-	705.0	5580.9	BLADE_R
24-HOUR	6.57E+00	-	-	687.9	5528.5	LVG_GAP
24-HOUR	6.38E+00	-	-	683.8	5536.1	OM_RVR
24-HOUR	5.78E+00	-	-	682.4	5537.3	ATRM_EN
24-HOUR	6.05E+00	-	-	679.9	5540.0	CBN_RDG
24-HOUR	8.82E+00	-	-	676.2	5544.3	CR_HM_EN
24-HOUR	8.99E+00	-	-	675.0	5545.1	HNYMNCRK
24-HOUR	8.75E+00	-	-	685.8	5539.1	BLADE_C
24-HOUR	8.33E+00	-	-	686.0	5539.1	MCLY_CRK
24-HOUR	3.94E+00	-	-	696.5	5525.0	DENNIS
24-HOUR	6.84E+00	-	-	687.5	5551.0	PLT_NE
24-HOUR	7.12E+00	-	-	679.1	5564.1	PLT_NW
24-HOUR	3.37E+01	-	-	681.9	5545.5	PLT_SW
24-HOUR	9.55E+00	-	-	687.3	5545.7	PLT_SE
24-HOUR	2.17E+00	-	-	698.3	5548.5	RCKP_E
24-HOUR	2.81E+00	-	-	672.1	5577.0	RCKP_NE
24-HOUR	1.75E+00	-	-	659.4	5576.5	RCKP_NW
24-HOUR	2.92E+01	-	-	673.2	5534.9	RCKP_SW
24-HOUR	3.20E+00	-	-	699.6	5536.4	RCKP_SE
24-HOUR	9.36E-01	-	-	714.5	5579.1	PLATEAU
24-HOUR	3.86E+00	-	-	693.4	5519.2	AP
24-HOUR	4.14E+00	-	-	693.4	5515.3	CABIN
24-HOUR	9.50E+01	-	-	685.0	5514.3	R2
24-HOUR	4.14E+00	-	-	693.4	5515.3	R5
24-HOUR	1.57E+01	-	-	687.7	5510.2	R11

PM10 - Concentration: [ug/m**3]						
Average Period	100th Percentile (1st Highest)	99.9th Percentile (9th Highest)	50th Percentile (average)	X [km]	Y [km]	Receptor ID
Max						
1-HOUR	2566.30	2212.30	97.68	678.0	5518	644
24-HOUR	772.88	-	-	678.0	5518	644
8760-HOUR	185.92	-	-	679.0	5519	716
Sensitive						
8760-HOUR	7.92E-02	-	-	690.1	5588.0	CARTWRT
8760-HOUR	3.93E-01	-	-	696.4	5548.3	CHIMNEY
8760-HOUR	1.12E-01	-	-	695.8	5573.6	BB_RANCH
8760-HOUR	7.99E-01	-	-	685.3	5523.3	RH_CRK
8760-HOUR	1.02E-01	-	-	672.4	5573.6	CTRT_CRK
8760-HOUR	4.64E-01	-	-	672.8	5547.1	OLDM_RF
8760-HOUR	2.10E+00	-	-	683.1	5552.9	LVST_F
8760-HOUR	9.77E-01	-	-	683.4	5556.6	PLT_MC
8760-HOUR	1.12E-01	-	-	695.8	5573.6	C_GARDN
8760-HOUR	1.01E-01	-	-	696.7	5576.4	S_GARDN
8760-HOUR	1.46E-01	-	-	700.6	5565.0	RLND_MB
8760-HOUR	3.02E-01	-	-	694.7	5555.1	R_BLAKE
8760-HOUR	2.92E-01	-	-	693.2	5556.8	B_RANSOM
8760-HOUR	2.57E-01	-	-	699.4	5555.2	RCKP_PLC
8760-HOUR	3.70E-01	-	-	697.4	5548.7	S_HARVEY
8760-HOUR	3.33E-01	-	-	697.6	5550.6	R_DAVIS
8760-HOUR	3.51E-01	-	-	696.5	5549.3	RESIDEN
8760-HOUR	3.49E-01	-	-	696.8	5549.5	COCHLAN
8760-HOUR	1.74E+00	-	-	683.8	5544.9	N_RCKP
8760-HOUR	3.36E-01	-	-	671.4	5550.3	NW_RCKP
8760-HOUR	8.58E-01	-	-	686.7	5535.8	S_RCKP
8760-HOUR	1.01E+00	-	-	695.4	5543.1	E_RCKP
8760-HOUR	1.03E+00	-	-	676.7	5540.5	W_RCKP
8760-HOUR	3.55E-01	-	-	705.0	5535.6	WLDRN_N
8760-HOUR	4.65E-01	-	-	705.9	5523.4	WLDRN_S
8760-HOUR	4.79E-01	-	-	697.2	5528.8	BOB_BNB
8760-HOUR	8.32E-02	-	-	705.0	5580.9	BLADE_R
8760-HOUR	6.71E-01	-	-	687.9	5528.5	LVG_GAP
8760-HOUR	9.46E-01	-	-	683.8	5536.1	OM_RVR
8760-HOUR	9.63E-01	-	-	682.4	5537.3	ATRM_EN
8760-HOUR	7.22E-01	-	-	679.9	5540.0	CBN_RDG
8760-HOUR	6.15E-01	-	-	676.2	5544.3	CR_HM_EN
8760-HOUR	5.84E-01	-	-	675.0	5545.1	HNYMNCRK
8760-HOUR	1.48E+00	-	-	685.8	5539.1	BLADE_C
8760-HOUR	1.46E+00	-	-	686.0	5539.1	MCLY_CRK
8760-HOUR	5.62E-01	-	-	696.5	5525.0	DENNIS
8760-HOUR	1.44E+00	-	-	687.5	5551.0	PLT_NE
8760-HOUR	3.10E-01	-	-	679.1	5564.1	PLT_NW
8760-HOUR	4.91E+00	-	-	681.9	5545.5	PLT_SW
8760-HOUR	1.62E+00	-	-	687.3	5545.7	PLT_SE
8760-HOUR	4.16E-01	-	-	698.3	5548.5	RCKP_E
8760-HOUR	9.41E-02	-	-	672.1	5577.0	RCKP_NE
8760-HOUR	5.29E-02	-	-	659.4	5576.5	RCKP_NW
8760-HOUR	3.54E+00	-	-	673.2	5534.9	RCKP_SW
8760-HOUR	5.05E-01	-	-	699.6	5536.4	RCKP_SE
8760-HOUR	8.98E-02	-	-	714.5	5579.1	PLATEAU
8760-HOUR	1.05E+00	-	-	693.4	5519.2	AP
8760-HOUR	8.20E-01	-	-	693.4	5515.3	CABIN
8760-HOUR	6.57E+00	-	-	685.0	5514.3	R2
8760-HOUR	8.20E-01	-	-	693.4	5515.3	R5
8760-HOUR	2.03E+00	-	-	687.7	5510.2	R11

TSP - Concentration: [ug/m**3]						
Average Period	100th Percentile (1st Highest)	99.9th Percentile (9th Highest)	Average	X [km]	Y [km]	Receptor ID
Max						
1-HOUR	9436.60	8282.30	385.66	678.0	5518	644
24-HOUR	2581.50	-	-	678.0	5518	644
8760-HOUR	719.01	-	-	679.0	5519.0	716
Sensitive						
1-HOUR	4.41E+00	2.61E+00	0.00E+00	690.1	5588.0	CARTWRT
1-HOUR	1.06E+01	7.32E+00	3.30E-01	696.4	5548.3	CHIMNEY
1-HOUR	7.09E+00	3.55E+00	0.00E+00	695.8	5573.6	BB_RANCH
1-HOUR	7.10E+01	4.19E+01	2.10E-02	685.3	5523.3	RH_CRK
1-HOUR	4.36E+00	2.82E+00	0.00E+00	672.4	5573.6	CTRT_CRK
1-HOUR	3.20E+01	2.52E+01	0.00E+00	672.8	5547.1	OLDM_RF
1-HOUR	1.36E+02	6.86E+01	2.01E+00	683.1	5552.9	LVST_F
1-HOUR	8.21E+01	5.32E+01	0.00E+00	683.4	5556.6	PLT_MC
1-HOUR	7.07E+00	3.53E+00	0.00E+00	695.8	5573.6	C_GARDN
1-HOUR	5.74E+00	3.05E+00	0.00E+00	696.7	5576.4	S_GARDN
1-HOUR	6.90E+00	4.04E+00	1.84E-10	700.6	5565.0	RLND_MB
1-HOUR	1.27E+01	6.87E+00	7.48E-02	694.7	5555.1	R_BLAKE
1-HOUR	1.36E+01	6.47E+00	1.55E-02	693.2	5556.8	B_RANSOM
1-HOUR	9.28E+00	5.76E+00	6.35E-02	699.4	5555.2	RCKP_PLC
1-HOUR	9.99E+00	6.93E+00	3.00E-01	697.4	5548.7	S_HARVEY
1-HOUR	9.99E+00	6.52E+00	2.45E-01	697.6	5550.6	R_DAVIS
1-HOUR	1.04E+01	6.89E+00	2.67E-01	696.5	5549.3	RESIDEN
1-HOUR	9.98E+00	6.79E+00	2.66E-01	696.8	5549.5	COCHLAN
1-HOUR	8.01E+01	5.00E+01	1.19E+00	683.8	5544.9	N_RCKP
1-HOUR	1.51E+01	1.06E+01	0.00E+00	671.4	5550.3	NW_RCKP
1-HOUR	8.00E+01	3.67E+01	3.18E-01	686.7	5535.8	S_RCKP
1-HOUR	3.58E+01	1.76E+01	7.62E-01	695.4	5543.1	E_RCKP
1-HOUR	1.25E+02	5.61E+01	0.00E+00	676.7	5540.5	W_RCKP
1-HOUR	1.11E+01	6.27E+00	1.34E-01	705.0	5535.6	WLDRN_N
1-HOUR	1.34E+01	6.67E+00	3.22E-01	705.9	5523.4	WLDRN_S
1-HOUR	1.38E+01	8.24E+00	8.73E-02	697.2	5528.8	BOB_BNB
1-HOUR	3.06E+00	2.18E+00	0.00E+00	705.0	5580.9	BLADE_R
1-HOUR	2.67E+01	1.60E+01	1.01E-02	687.9	5528.5	LVG_GAP
1-HOUR	6.38E+01	2.52E+01	5.55E-01	683.8	5536.1	OM_RVR
1-HOUR	5.19E+01	2.83E+01	5.42E-01	682.4	5537.3	ATRM_EN
1-HOUR	3.06E+01	1.96E+01	1.58E-01	679.9	5540.0	CBN_RDG
1-HOUR	4.42E+01	2.82E+01	0.00E+00	676.2	5544.3	CR_HM_EN
1-HOUR	4.81E+01	3.06E+01	0.00E+00	675.0	5545.1	HNYMNCRK
1-HOUR	2.05E+02	5.91E+01	8.64E-01	685.8	5539.1	BLADE_C
1-HOUR	1.97E+02	5.71E+01	8.68E-01	686.0	5539.1	MCLY_CRK
1-HOUR	1.60E+01	8.86E+00	2.08E-01	696.5	5525.0	DENNIS
1-HOUR	5.51E+01	3.74E+01	1.12E+00	687.5	5551.0	PLT_NE
1-HOUR	2.11E+01	9.11E+00	0.00E+00	679.1	5564.1	PLT_NW
1-HOUR	9.42E+01	7.41E+01	6.13E+00	681.9	5545.5	PLT_SW
1-HOUR	6.35E+01	4.35E+01	1.02E+00	687.3	5545.7	PLT_SE
1-HOUR	1.04E+01	7.01E+00	3.59E-01	698.3	5548.5	RCKP_E
1-HOUR	3.97E+00	2.61E+00	0.00E+00	672.1	5577.0	RCKP_NE
1-HOUR	2.11E+00	1.68E+00	0.00E+00	659.4	5576.5	RCKP_NW
1-HOUR	2.44E+02	1.60E+02	0.00E+00	673.2	5534.9	RCKP_SW
1-HOUR	1.89E+01	8.86E+00	2.35E-01	699.6	5536.4	RCKP_SE
1-HOUR	4.73E+00	2.85E+00	0.00E+00	714.5	5579.1	PLATEAU
1-HOUR	1.67E+01	1.34E+01	9.50E-01	693.4	5519.2	AP
1-HOUR	1.77E+01	1.49E+01	2.13E-01	693.4	5515.3	CABIN
1-HOUR	4.49E+02	4.11E+02	2.10E+00	685.0	5514.3	R2
1-HOUR	1.77E+01	1.49E+01	2.13E-01	693.4	5515.3	R5
1-HOUR	7.83E+01	5.79E+01	4.62E-01	687.7	5510.2	R11

TSP - Concentration: [ug/m**3]						
Average Period	100th Percentile (1st Highest)	99.9th Percentile (9th Highest)	Average	X [km]	Y [km]	Receptor ID
Max						
1-HOUR	9436.60	8282.30	385.66	678.0	5518	644
24-HOUR	2581.50	-	-	678.0	5518	644
8760-HOUR	719.01	-	-	679.0	5519.0	716
Sensitive						
24-HOUR	1.06E+00	-	-	690.1	5588.0	CARTWRT
24-HOUR	2.59E+00	-	-	696.4	5548.3	CHIMNEY
24-HOUR	1.47E+00	-	-	695.8	5573.6	BB_RANCH
24-HOUR	1.07E+01	-	-	685.3	5523.3	RH_CRK
24-HOUR	1.33E+00	-	-	672.4	5573.6	CTRT_CRK
24-HOUR	7.27E+00	-	-	672.8	5547.1	OLDM_RF
24-HOUR	2.10E+01	-	-	683.1	5552.9	LVST_F
24-HOUR	1.45E+01	-	-	683.4	5556.6	PLT_MC
24-HOUR	1.46E+00	-	-	695.8	5573.6	C_GARDN
24-HOUR	1.19E+00	-	-	696.7	5576.4	S_GARDN
24-HOUR	1.46E+00	-	-	700.6	5565.0	RLND_MB
24-HOUR	2.40E+00	-	-	694.7	5555.1	R_BLAKE
24-HOUR	2.57E+00	-	-	693.2	5556.8	B_RANSOM
24-HOUR	1.67E+00	-	-	699.4	5555.2	RCKP_PLC
24-HOUR	2.26E+00	-	-	697.4	5548.7	S_HARVEY
24-HOUR	2.21E+00	-	-	697.6	5550.6	R_DAVIS
24-HOUR	2.59E+00	-	-	696.5	5549.3	RESIDEN
24-HOUR	2.46E+00	-	-	696.8	5549.5	COCHLAN
24-HOUR	1.76E+01	-	-	683.8	5544.9	N_RCKP
24-HOUR	4.28E+00	-	-	671.4	5550.3	NW_RCKP
24-HOUR	7.98E+00	-	-	686.7	5535.8	S_RCKP
24-HOUR	5.35E+00	-	-	695.4	5543.1	E_RCKP
24-HOUR	1.59E+01	-	-	676.7	5540.5	W_RCKP
24-HOUR	1.67E+00	-	-	705.0	5535.6	WLDRN_N
24-HOUR	1.64E+00	-	-	705.9	5523.4	WLDRN_S
24-HOUR	2.22E+00	-	-	697.2	5528.8	BOB_BNB
24-HOUR	6.78E-01	-	-	705.0	5580.9	BLADE_R
24-HOUR	4.19E+00	-	-	687.9	5528.5	LVG_GAP
24-HOUR	5.93E+00	-	-	683.8	5536.1	OM_RVR
24-HOUR	5.63E+00	-	-	682.4	5537.3	ATRM_EN
24-HOUR	5.80E+00	-	-	679.9	5540.0	CBN_RDG
24-HOUR	8.80E+00	-	-	676.2	5544.3	CR_HM_EN
24-HOUR	1.05E+01	-	-	675.0	5545.1	HNYMNCRK
24-HOUR	1.27E+01	-	-	685.8	5539.1	BLADE_C
24-HOUR	1.22E+01	-	-	686.0	5539.1	MCLY_CRK
24-HOUR	2.25E+00	-	-	696.5	5525.0	DENNIS
24-HOUR	9.13E+00	-	-	687.5	5551.0	PLT_NE
24-HOUR	4.80E+00	-	-	679.1	5564.1	PLT_NW
24-HOUR	3.37E+01	-	-	681.9	5545.5	PLT_SW
24-HOUR	1.11E+01	-	-	687.3	5545.7	PLT_SE
24-HOUR	2.06E+00	-	-	698.3	5548.5	RCKP_E
24-HOUR	1.17E+00	-	-	672.1	5577.0	RCKP_NE
24-HOUR	4.95E-01	-	-	659.4	5576.5	RCKP_NW
24-HOUR	4.92E+01	-	-	673.2	5534.9	RCKP_SW
24-HOUR	2.34E+00	-	-	699.6	5536.4	RCKP_SE
24-HOUR	6.21E-01	-	-	714.5	5579.1	PLATEAU
24-HOUR	5.53E+00	-	-	693.4	5519.2	AP
24-HOUR	5.51E+00	-	-	693.4	5515.3	CABIN
24-HOUR	1.45E+02	-	-	685.0	5514.3	R2
24-HOUR	5.51E+00	-	-	693.4	5515.3	R5
24-HOUR	1.95E+01	-	-	687.7	5510.2	R11

TSP - Concentration: [ug/m**3]						
Average Period	100th Percentile (1st Highest)	99.9th Percentile (9th Highest)	Average	X [km]	Y [km]	Receptor ID
Max						
1-HOUR	9436.60	8282.30	385.66	678.0	5518	644
24-HOUR	2581.50	-	-	678.0	5518	644
8760-HOUR	719.01	-	-	679.0	5519.0	716
Sensitive						
8760-HOUR	5.10E-02	-	-	690.1	5588.0	CARTWRT
8760-HOUR	5.45E-01	-	-	696.4	5548.3	CHIMNEY
8760-HOUR	8.63E-02	-	-	695.8	5573.6	BB_RANCH
8760-HOUR	9.39E-01	-	-	685.3	5523.3	RH_CRK
8760-HOUR	5.52E-02	-	-	672.4	5573.6	CTRT_CRK
8760-HOUR	4.81E-01	-	-	672.8	5547.1	OLDM_RF
8760-HOUR	3.82E+00	-	-	683.1	5552.9	LVST_F
8760-HOUR	1.25E+00	-	-	683.4	5556.6	PLT_MC
8760-HOUR	8.63E-02	-	-	695.8	5573.6	C_GARDN
8760-HOUR	7.44E-02	-	-	696.7	5576.4	S_GARDN
8760-HOUR	1.48E-01	-	-	700.6	5565.0	RLND_MB
8760-HOUR	4.13E-01	-	-	694.7	5555.1	R_BLAKE
8760-HOUR	3.93E-01	-	-	693.2	5556.8	B_RANSOM
8760-HOUR	3.37E-01	-	-	699.4	5555.2	RCKP_PLC
8760-HOUR	5.07E-01	-	-	697.4	5548.7	S_HARVEY
8760-HOUR	4.53E-01	-	-	697.6	5550.6	R_DAVIS
8760-HOUR	4.77E-01	-	-	696.5	5549.3	RESIDEN
8760-HOUR	4.74E-01	-	-	696.8	5549.5	COCHLAN
8760-HOUR	2.90E+00	-	-	683.8	5544.9	N_RCKP
8760-HOUR	2.87E-01	-	-	671.4	5550.3	NW_RCKP
8760-HOUR	1.19E+00	-	-	686.7	5535.8	S_RCKP
8760-HOUR	1.64E+00	-	-	695.4	5543.1	E_RCKP
8760-HOUR	1.40E+00	-	-	676.7	5540.5	W_RCKP
8760-HOUR	4.29E-01	-	-	705.0	5535.6	WLDRN_N
8760-HOUR	6.23E-01	-	-	705.9	5523.4	WLDRN_S
8760-HOUR	5.60E-01	-	-	697.2	5528.8	BOB_BNB
8760-HOUR	6.40E-02	-	-	705.0	5580.9	BLADE_R
8760-HOUR	8.00E-01	-	-	687.9	5528.5	LVG_GAP
8760-HOUR	1.38E+00	-	-	683.8	5536.1	OM_RVR
8760-HOUR	1.36E+00	-	-	682.4	5537.3	ATRM_EN
8760-HOUR	8.89E-01	-	-	679.9	5540.0	CBN_RDG
8760-HOUR	7.69E-01	-	-	676.2	5544.3	CR_HM_EN
8760-HOUR	6.96E-01	-	-	675.0	5545.1	HNYMNCRK
8760-HOUR	2.42E+00	-	-	685.8	5539.1	BLADE_C
8760-HOUR	2.39E+00	-	-	686.0	5539.1	MCLY_CRK
8760-HOUR	7.13E-01	-	-	696.5	5525.0	DENNIS
8760-HOUR	2.61E+00	-	-	687.5	5551.0	PLT_NE
8760-HOUR	2.15E-01	-	-	679.1	5564.1	PLT_NW
8760-HOUR	9.03E+00	-	-	681.9	5545.5	PLT_SW
8760-HOUR	2.82E+00	-	-	687.3	5545.7	PLT_SE
8760-HOUR	5.86E-01	-	-	698.3	5548.5	RCKP_E
8760-HOUR	4.77E-02	-	-	672.1	5577.0	RCKP_NE
8760-HOUR	2.75E-02	-	-	659.4	5576.5	RCKP_NW
8760-HOUR	5.06E+00	-	-	673.2	5534.9	RCKP_SW
8760-HOUR	6.57E-01	-	-	699.6	5536.4	RCKP_SE
8760-HOUR	8.04E-02	-	-	714.5	5579.1	PLATEAU
8760-HOUR	1.76E+00	-	-	693.4	5519.2	AP
8760-HOUR	1.15E+00	-	-	693.4	5515.3	CABIN
8760-HOUR	9.60E+00	-	-	685.0	5514.3	R2
8760-HOUR	1.15E+00	-	-	693.4	5515.3	R5
8760-HOUR	2.56E+00	-	-	687.7	5510.2	R11

SO2 - Concentration: [ug/m**3]							
Average Period	100th Percentile (1st Highest)	99.9th Percentile	99th Percentile	Average (50th percentile)	X [km]	Y [km]	Receptor ID
MPOI							
1-HOUR	32.23	28.96	16.83	1.26	678.0	5518	644
24-HOUR	12.08	-	-	-	678.0	5518	644
720-HOUR	2.69	-	-	-	679.0	5519.0	716
8760-HOUR	1.93	-	-	-	679.0	5519.0	716
Sensitive							
1-HOUR	5.42E-02	4.09E-02	1.98E-02	0.00E+00	690.1	5588.0	CARTWRT
1-HOUR	1.18E-01	8.76E-02	5.27E-02	2.71E-03	696.4	5548.3	CHIMNEY
1-HOUR	7.96E-02	5.73E-02	3.06E-02	0.00E+00	695.8	5573.6	BB_RANCH
1-HOUR	1.39E+00	1.10E+00	5.48E-01	1.01E-03	685.3	5523.3	RH_CRK
1-HOUR	6.82E-02	5.34E-02	2.78E-02	0.00E+00	672.4	5573.6	CTRT_CRK
1-HOUR	1.50E-01	1.13E-01	6.74E-02	0.00E+00	672.8	5547.1	OLDM_RF
1-HOUR	4.02E+00	2.99E+00	1.31E+00	5.26E-02	683.1	5552.9	LVST_F
1-HOUR	9.74E-01	7.62E-01	3.96E-01	0.00E+00	683.4	5556.6	PLT_MC
1-HOUR	7.94E-02	5.71E-02	3.06E-02	0.00E+00	695.8	5573.6	C_GARDN
1-HOUR	6.94E-02	4.96E-02	2.62E-02	0.00E+00	696.7	5576.4	S_GARDN
1-HOUR	7.26E-02	5.66E-02	3.61E-02	6.18E-10	700.6	5565.0	RLND_MB
1-HOUR	1.19E-01	8.92E-02	6.20E-02	1.42E-03	694.7	5555.1	R_BLAKE
1-HOUR	1.41E-01	1.04E-01	6.28E-02	7.49E-04	693.2	5556.8	B_RANSOM
1-HOUR	9.48E-02	6.60E-02	4.62E-02	1.25E-03	699.4	5555.2	RCKP_PLC
1-HOUR	1.02E-01	7.94E-02	4.86E-02	2.51E-03	697.4	5548.7	S_HARVEY
1-HOUR	9.76E-02	7.02E-02	4.73E-02	2.13E-03	697.6	5550.6	R_DAVIS
1-HOUR	1.02E-01	8.20E-02	5.02E-02	2.43E-03	696.5	5549.3	RESIDEN
1-HOUR	9.87E-02	8.24E-02	4.86E-02	2.37E-03	696.8	5549.5	COCHLAN
1-HOUR	2.86E+00	2.44E+00	1.28E+00	4.58E-03	683.8	5544.9	N_RCKP
1-HOUR	1.66E-01	1.05E-01	5.00E-02	0.00E+00	671.4	5550.3	NW_RCKP
1-HOUR	7.76E-01	5.62E-01	3.24E-01	4.64E-03	686.7	5535.8	S_RCKP
1-HOUR	1.81E-01	1.30E-01	8.71E-02	4.40E-03	695.4	5543.1	E_RCKP
1-HOUR	5.78E-01	4.53E-01	1.82E-01	0.00E+00	676.7	5540.5	W_RCKP
1-HOUR	1.19E-01	8.23E-02	4.87E-02	2.16E-03	705.0	5535.6	WLDRN_N
1-HOUR	1.39E-01	1.15E-01	8.64E-02	4.64E-03	705.9	5523.4	WLDRN_S
1-HOUR	2.35E-01	1.53E-01	8.30E-02	1.71E-03	697.2	5528.8	BOB_BNB
1-HOUR	4.59E-02	3.64E-02	2.03E-02	0.00E+00	705.0	5580.9	BLADE_R
1-HOUR	3.22E-01	2.75E-01	1.66E-01	2.04E-04	687.9	5528.5	LVG_GAP
1-HOUR	1.24E+00	8.36E-01	4.42E-01	7.58E-03	683.8	5536.1	OM_RVR
1-HOUR	1.10E+00	7.64E-01	3.70E-01	9.36E-03	682.4	5537.3	ATRM_EN
1-HOUR	7.92E-01	2.30E-01	1.41E-01	1.29E-03	679.9	5540.0	CBN_RDG
1-HOUR	3.83E-01	2.91E-01	1.37E-01	0.00E+00	676.2	5544.3	CR_HM_EN
1-HOUR	3.17E-01	2.05E-01	1.02E-01	0.00E+00	675.0	5545.1	HNYMNCRK
1-HOUR	2.24E+00	1.80E+00	1.00E+00	1.11E-02	685.8	5539.1	BLADE_C
1-HOUR	2.24E+00	1.69E+00	8.76E-01	1.09E-02	686.0	5539.1	MCLY_CRK
1-HOUR	2.94E-01	1.77E-01	1.18E-01	4.70E-03	696.5	5525.0	DENNIS
1-HOUR	5.17E-01	2.47E-01	1.35E-01	3.80E-03	687.5	5551.0	PLT_NE
1-HOUR	1.89E-01	1.27E-01	7.40E-02	0.00E+00	679.1	5564.1	PLT_NW
1-HOUR	1.20E+00	8.16E-01	4.83E-01	1.19E-02	681.9	5545.5	PLT_SW
1-HOUR	4.24E-01	3.23E-01	1.70E-01	3.37E-03	687.3	5545.7	PLT_SE
1-HOUR	9.53E-02	7.60E-02	4.71E-02	2.54E-03	698.3	5548.5	RCKP_E
1-HOUR	5.35E-02	4.68E-02	2.38E-02	0.00E+00	672.1	5577.0	RCKP_NE
1-HOUR	5.01E-02	2.67E-02	1.13E-02	0.00E+00	659.4	5576.5	RCKP_NW
1-HOUR	2.15E+00	1.54E+00	9.44E-01	0.00E+00	673.2	5534.9	RCKP_SW
1-HOUR	1.22E-01	9.70E-02	6.30E-02	2.42E-03	699.6	5536.4	RCKP_SE
1-HOUR	4.59E-02	3.57E-02	2.20E-02	0.00E+00	714.5	5579.1	PLATEAU
1-HOUR	2.55E-01	2.10E-01	1.21E-01	9.27E-03	693.4	5519.2	AP
1-HOUR	2.97E-01	1.92E-01	1.18E-01	2.49E-03	693.4	5515.3	CABIN
1-HOUR	1.49E+00	1.36E+00	9.96E-01	2.94E-02	685.0	5514.3	R2
1-HOUR	2.96E-01	1.85E-01	1.17E-01	2.48E-03	693.4	5515.3	R5
1-HOUR	5.31E+00	4.17E+00	2.33E+00	6.56E-03	687.7	5510.2	R11

SO2 - Concentration: [ug/m**3]							
Average Period	100th Percentile (1st Highest)	99.9th Percentile	99th Percentile	Average (50th percentile)	X [km]	Y [km]	Receptor ID
MPOI							
1-HOUR	32.23	28.96	16.83	1.26	678.0	5518	644
24-HOUR	12.08	-	-	-	678.0	5518	644
720-HOUR	2.69	-	-	-	679.0	5519.0	716
8760-HOUR	1.93	-	-	-	679.0	5519.0	716
Sensitive							
24-HOUR	1.46E-02	-			690.1	5588.0	CARTWRT
24-HOUR	3.49E-02	-			696.4	5548.3	CHIMNEY
24-HOUR	2.08E-02	-			695.8	5573.6	BB_RANCH
24-HOUR	2.61E-01	-			685.3	5523.3	RH_CRK
24-HOUR	2.93E-02	-			672.4	5573.6	CTRT_CRK
24-HOUR	4.73E-02	-			672.8	5547.1	OLDM_RF
24-HOUR	8.52E-01	-			683.1	5552.9	LVST_F
24-HOUR	2.04E-01	-			683.4	5556.6	PLT_MC
24-HOUR	2.08E-02	-			695.8	5573.6	C_GARDN
24-HOUR	1.96E-02	-			696.7	5576.4	S_GARDN
24-HOUR	2.25E-02	-			700.6	5565.0	RLND_MB
24-HOUR	3.26E-02	-			694.7	5555.1	R_BLAKE
24-HOUR	3.37E-02	-			693.2	5556.8	B_RANSOM
24-HOUR	2.91E-02	-			699.4	5555.2	RCKP_PLC
24-HOUR	3.27E-02	-			697.4	5548.7	S_HARVEY
24-HOUR	3.33E-02	-			697.6	5550.6	R_DAVIS
24-HOUR	3.56E-02	-			696.5	5549.3	RESIDEN
24-HOUR	3.47E-02	-			696.8	5549.5	COCHLAN
24-HOUR	6.78E-01	-			683.8	5544.9	N_RCKP
24-HOUR	4.13E-02	-			671.4	5550.3	NW_RCKP
24-HOUR	1.72E-01	-			686.7	5535.8	S_RCKP
24-HOUR	4.17E-02	-			695.4	5543.1	E_RCKP
24-HOUR	1.07E-01	-			676.7	5540.5	W_RCKP
24-HOUR	3.09E-02	-			705.0	5535.6	WLDRN_N
24-HOUR	5.18E-02	-			705.9	5523.4	WLDRN_S
24-HOUR	4.21E-02	-			697.2	5528.8	BOB_BNB
24-HOUR	1.47E-02	-			705.0	5580.9	BLADE_R
24-HOUR	7.67E-02	-			687.9	5528.5	LVG_GAP
24-HOUR	2.40E-01	-			683.8	5536.1	OM_RVR
24-HOUR	2.37E-01	-			682.4	5537.3	ATRM_EN
24-HOUR	1.04E-01	-			679.9	5540.0	CBN_RDG
24-HOUR	9.65E-02	-			676.2	5544.3	CR_HM_EN
24-HOUR	7.82E-02	-			675.0	5545.1	HNYMNCRK
24-HOUR	5.15E-01	-			685.8	5539.1	BLADE_C
24-HOUR	4.70E-01	-			686.0	5539.1	MCLY_CRK
24-HOUR	6.83E-02	-			696.5	5525.0	DENNIS
24-HOUR	5.19E-02	-			687.5	5551.0	PLT_NE
24-HOUR	8.17E-02	-			679.1	5564.1	PLT_NW
24-HOUR	3.66E-01	-			681.9	5545.5	PLT_SW
24-HOUR	7.00E-02	-			687.3	5545.7	PLT_SE
24-HOUR	3.12E-02	-			698.3	5548.5	RCKP_E
24-HOUR	2.72E-02	-			672.1	5577.0	RCKP_NE
24-HOUR	1.13E-02	-			659.4	5576.5	RCKP_NW
24-HOUR	4.40E-01	-			673.2	5534.9	RCKP_SW
24-HOUR	2.86E-02	-			699.6	5536.4	RCKP_SE
24-HOUR	1.08E-02	-			714.5	5579.1	PLATEAU
24-HOUR	8.64E-02	-			693.4	5519.2	AP
24-HOUR	6.18E-02	-			693.4	5515.3	CABIN
24-HOUR	5.50E-01	-			685.0	5514.3	R2
24-HOUR	6.13E-02	-			693.4	5515.3	R5
24-HOUR	8.78E-01	-			687.7	5510.2	R11

SO2 - Concentration: [ug/m**3]							
Average Period	100th Percentile (1st Highest)	99.9th Percentile	99th Percentile	Average (50th percentile)	X [km]	Y [km]	Receptor ID
MPOI							
1-HOUR	32.23	28.96	16.83	1.26	678.0	5518	644
24-HOUR	12.08	-	-	-	678.0	5518	644
720-HOUR	2.69	-	-	-	679.0	5519.0	716
8760-HOUR	1.93	-	-	-	679.0	5519.0	716
Sensitive							
720-HOUR	2.14E-03	-			690.1	5588.0	CARTWRT
720-HOUR	9.89E-03	-			696.4	5548.3	CHIMNEY
720-HOUR	2.84E-03	-			695.8	5573.6	BB_RANCH
720-HOUR	5.23E-02	-			685.3	5523.3	RH_CRK
720-HOUR	3.20E-03	-			672.4	5573.6	CTRT_CRK
720-HOUR	6.86E-03	-			672.8	5547.1	OLDM_RF
720-HOUR	1.55E-01	-			683.1	5552.9	LVST_F
720-HOUR	3.73E-02	-			683.4	5556.6	PLT_MC
720-HOUR	2.84E-03	-			695.8	5573.6	C_GARDN
720-HOUR	2.60E-03	-			696.7	5576.4	S_GARDN
720-HOUR	4.64E-03	-			700.6	5565.0	RLND_MB
720-HOUR	1.01E-02	-			694.7	5555.1	R_BLAKE
720-HOUR	1.01E-02	-			693.2	5556.8	B_RANSOM
720-HOUR	8.44E-03	-			699.4	5555.2	RCKP_PLC
720-HOUR	9.29E-03	-			697.4	5548.7	S_HARVEY
720-HOUR	8.32E-03	-			697.6	5550.6	R_DAVIS
720-HOUR	9.02E-03	-			696.5	5549.3	RESIDEN
720-HOUR	8.85E-03	-			696.8	5549.5	COCHLAN
720-HOUR	1.20E-01	-			683.8	5544.9	N_RCKP
720-HOUR	4.87E-03	-			671.4	5550.3	NW_RCKP
720-HOUR	3.47E-02	-			686.7	5535.8	S_RCKP
720-HOUR	1.55E-02	-			695.4	5543.1	E_RCKP
720-HOUR	1.59E-02	-			676.7	5540.5	W_RCKP
720-HOUR	8.85E-03	-			705.0	5535.6	WLDRN_N
720-HOUR	1.92E-02	-			705.9	5523.4	WLDRN_S
720-HOUR	1.30E-02	-			697.2	5528.8	BOB_BNB
720-HOUR	2.02E-03	-			705.0	5580.9	BLADE_R
720-HOUR	1.73E-02	-			687.9	5528.5	LVG_GAP
720-HOUR	3.99E-02	-			683.8	5536.1	OM_RVR
720-HOUR	3.98E-02	-			682.4	5537.3	ATRM_EN
720-HOUR	2.09E-02	-			679.9	5540.0	CBN_RDG
720-HOUR	1.34E-02	-			676.2	5544.3	CR_HM_EN
720-HOUR	9.76E-03	-			675.0	5545.1	HNYMNCRK
720-HOUR	9.34E-02	-			685.8	5539.1	BLADE_C
720-HOUR	8.79E-02	-			686.0	5539.1	MCLY_CRK
720-HOUR	1.90E-02	-			696.5	5525.0	DENNIS
720-HOUR	1.80E-02	-			687.5	5551.0	PLT_NE
720-HOUR	7.89E-03	-			679.1	5564.1	PLT_NW
720-HOUR	6.53E-02	-			681.9	5545.5	PLT_SW
720-HOUR	2.27E-02	-			687.3	5545.7	PLT_SE
720-HOUR	9.33E-03	-			698.3	5548.5	RCKP_E
720-HOUR	2.79E-03	-			672.1	5577.0	RCKP_NE
720-HOUR	1.50E-03	-			659.4	5576.5	RCKP_NW
720-HOUR	7.79E-02	-			673.2	5534.9	RCKP_SW
720-HOUR	1.03E-02	-			699.6	5536.4	RCKP_SE
720-HOUR	2.21E-03	-			714.5	5579.1	PLATEAU
720-HOUR	2.94E-02	-			693.4	5519.2	AP
720-HOUR	1.83E-02	-			693.4	5515.3	CABIN
720-HOUR	1.50E-01	-			685.0	5514.3	R2
720-HOUR	1.81E-02	-			693.4	5515.3	R5
720-HOUR	1.35E-01	-			687.7	5510.2	R11

SO2 - Concentration: [ug/m**3]							
Average Period	100th Percentile (1st Highest)	99.9th Percentile	99th Percentile	Average (50th percentile)	X [km]	Y [km]	Receptor ID
MPOI							
1-HOUR	32.23	28.96	16.83	1.26	678.0	5518	644
24-HOUR	12.08	-	-	-	678.0	5518	644
720-HOUR	2.69	-	-	-	679.0	5519.0	716
8760-HOUR	1.93	-	-	-	679.0	5519.0	716
Sensitive							
8760-HOUR	9.10E-04	-			690.1	5588.0	CARTWRT
8760-HOUR	7.14E-03	-			696.4	5548.3	CHIMNEY
8760-HOUR	1.44E-03	-			695.8	5573.6	BB_RANCH
8760-HOUR	2.87E-02	-			685.3	5523.3	RH_CRK
8760-HOUR	1.09E-03	-			672.4	5573.6	CTRT_CRK
8760-HOUR	4.12E-03	-			672.8	5547.1	OLDM_RF
8760-HOUR	1.03E-01	-			683.1	5552.9	LVST_F
8760-HOUR	1.68E-02	-			683.4	5556.6	PLT_MC
8760-HOUR	1.44E-03	-			695.8	5573.6	C_GARDN
8760-HOUR	1.30E-03	-			696.7	5576.4	S_GARDN
8760-HOUR	2.71E-03	-			700.6	5565.0	RLND_MB
8760-HOUR	7.40E-03	-			694.7	5555.1	R_BLAKE
8760-HOUR	6.84E-03	-			693.2	5556.8	B_RANSOM
8760-HOUR	5.97E-03	-			699.4	5555.2	RCKP_PLC
8760-HOUR	6.74E-03	-			697.4	5548.7	S_HARVEY
8760-HOUR	6.33E-03	-			697.6	5550.6	R_DAVIS
8760-HOUR	6.73E-03	-			696.5	5549.3	RESIDEN
8760-HOUR	6.61E-03	-			696.8	5549.5	COCHLAN
8760-HOUR	5.50E-02	-			683.8	5544.9	N_RCKP
8760-HOUR	2.95E-03	-			671.4	5550.3	NW_RCKP
8760-HOUR	2.06E-02	-			686.7	5535.8	S_RCKP
8760-HOUR	1.25E-02	-			695.4	5543.1	E_RCKP
8760-HOUR	9.89E-03	-			676.7	5540.5	W_RCKP
8760-HOUR	6.92E-03	-			705.0	5535.6	WLDRN_N
8760-HOUR	1.30E-02	-			705.9	5523.4	WLDRN_S
8760-HOUR	9.56E-03	-			697.2	5528.8	BOB_BNB
8760-HOUR	1.10E-03	-			705.0	5580.9	BLADE_R
8760-HOUR	1.18E-02	-			687.9	5528.5	LVG_GAP
8760-HOUR	2.94E-02	-			683.8	5536.1	OM_RVR
8760-HOUR	2.80E-02	-			682.4	5537.3	ATRM_EN
8760-HOUR	1.24E-02	-			679.9	5540.0	CBN_RDG
8760-HOUR	8.17E-03	-			676.2	5544.3	CR_HM_EN
8760-HOUR	6.21E-03	-			675.0	5545.1	HNYMNCRK
8760-HOUR	5.00E-02	-			685.8	5539.1	BLADE_C
8760-HOUR	4.70E-02	-			686.0	5539.1	MCLY_CRK
8760-HOUR	1.50E-02	-			696.5	5525.0	DENNIS
8760-HOUR	1.45E-02	-			687.5	5551.0	PLT_NE
8760-HOUR	3.03E-03	-			679.1	5564.1	PLT_NW
8760-HOUR	3.90E-02	-			681.9	5545.5	PLT_SW
8760-HOUR	1.69E-02	-			687.3	5545.7	PLT_SE
8760-HOUR	6.74E-03	-			698.3	5548.5	RCKP_E
8760-HOUR	9.51E-04	-			672.1	5577.0	RCKP_NE
8760-HOUR	5.04E-04	-			659.4	5576.5	RCKP_NW
8760-HOUR	4.74E-02	-			673.2	5534.9	RCKP_SW
8760-HOUR	7.92E-03	-			699.6	5536.4	RCKP_SE
8760-HOUR	1.33E-03	-			714.5	5579.1	PLATEAU
8760-HOUR	2.01E-02	-			693.4	5519.2	AP
8760-HOUR	1.29E-02	-			693.4	5515.3	CABIN
8760-HOUR	9.65E-02	-			685.0	5514.3	R2
8760-HOUR	1.28E-02	-			693.4	5515.3	R5
8760-HOUR	8.43E-02	-			687.7	5510.2	R11

NO2 - Concentration: [ug/m**3]							
Average Period	100th Percentile (1st Highest)	99.9th Percentile	98th Percentile	Average	X [km]	Y [km]	Receptor ID
MPOI							
1-HOUR	1263.10	1055.40	448.84	32.28	678.0	5518.0	644
24-HOUR	337.22	-	-	-	678.0	5518.0	644
720-HOUR	77.33	-	-	-	679.0	5519.0	716
8760-HOUR	60.21				679.0	5518.0	645
1-HOUR	6.42	4.57	1.47	0.00	690.1	5588.0	CARTWRT
1-HOUR	13.51	9.51	4.93	0.33	696.4	5548.3	CHIMNEY
1-HOUR	10.54	6.61	2.38	0.00	695.8	5573.6	BB_RANCH
1-HOUR	147.33	115.79	39.12	0.13	685.3	5523.3	RH_CRK
1-HOUR	8.09	6.17	1.78	0.00	672.4	5573.6	CTRT_CRK
1-HOUR	21.78	15.80	6.93	0.00	672.8	5547.1	OLDM_RF
1-HOUR	399.89	292.67	74.51	4.54	683.1	5552.9	LVST_F
1-HOUR	95.95	78.68	28.89	0.00	683.4	5556.6	PLT_MC
1-HOUR	10.52	6.62	2.38	0.00	695.8	5573.6	C_GARDN
1-HOUR	9.23	5.73	2.13	0.00	696.7	5576.4	S_GARDN
1-HOUR	9.34	6.37	3.36	0.00	700.6	5565.0	RLND_MB
1-HOUR	12.46	10.15	5.45	0.16	694.7	5555.1	R_BLAKE
1-HOUR	15.68	11.03	5.72	0.07	693.2	5556.8	B_RANSOM
1-HOUR	10.20	7.65	4.37	0.14	699.4	5555.2	RCKP_PLC
1-HOUR	11.92	8.65	4.70	0.31	697.4	5548.7	S_HARVEY
1-HOUR	10.94	7.91	4.40	0.26	697.6	5550.6	R_DAVIS
1-HOUR	12.26	9.06	4.67	0.30	696.5	5549.3	RESIDEN
1-HOUR	11.95	8.80	4.56	0.29	696.8	5549.5	COCHLAN
1-HOUR	295.64	243.53	70.89	0.69	683.8	5544.9	N_RCKP
1-HOUR	21.99	13.17	4.86	0.00	671.4	5550.3	NW_RCKP
1-HOUR	99.53	76.63	28.53	0.57	686.7	5535.8	S_RCKP
1-HOUR	21.84	15.06	8.39	0.49	695.4	5543.1	E_RCKP
1-HOUR	71.44	53.06	15.04	0.00	676.7	5540.5	W_RCKP
1-HOUR	13.52	8.92	4.73	0.22	705.0	5535.6	WLDRN_N
1-HOUR	15.72	13.10	7.95	0.48	705.9	5523.4	WLDRN_S
1-HOUR	25.66	16.78	7.82	0.19	697.2	5528.8	BOB_BNB
1-HOUR	5.46	4.23	1.75	0.00	705.0	5580.9	BLADE_R
1-HOUR	32.24	29.45	14.26	0.03	687.9	5528.5	LVG_GAP
1-HOUR	164.54	125.61	40.51	0.88	683.8	5536.1	OM_RVR
1-HOUR	164.69	123.69	37.05	1.07	682.4	5537.3	ATRM_EN
1-HOUR	83.22	33.90	14.72	0.23	679.9	5540.0	CBN_RDG
1-HOUR	62.73	49.77	14.94	0.00	676.2	5544.3	CR_HM_EN
1-HOUR	46.82	33.24	11.06	0.00	675.0	5545.1	HNYMNCRK
1-HOUR	294.39	243.60	66.79	1.80	685.8	5539.1	BLADE_C
1-HOUR	282.73	234.43	61.92	1.75	686.0	5539.1	MCLY_CRK
1-HOUR	34.71	18.68	10.58	0.46	696.5	5525.0	DENNIS
1-HOUR	47.86	25.07	11.17	0.58	687.5	5551.0	PLT_NE
1-HOUR	20.32	14.36	5.09	0.00	679.1	5564.1	PLT_NW
1-HOUR	126.45	99.81	55.62	1.90	681.9	5545.5	PLT_SW
1-HOUR	43.72	34.61	14.96	0.48	687.3	5545.7	PLT_SE
1-HOUR	11.42	7.95	4.67	0.30	698.3	5548.5	RCKP_E
1-HOUR	6.66	5.27	1.54	0.00	672.1	5577.0	RCKP_NE
1-HOUR	4.73	3.06	0.85	0.00	659.4	5576.5	RCKP_NW
1-HOUR	183.00	132.52	67.55	0.00	673.2	5534.9	RCKP_SW
1-HOUR	13.55	11.83	5.70	0.26	699.6	5536.4	RCKP_SE
1-HOUR	5.09	4.16	1.88	0.00	714.5	5579.1	PLATEAU
1-HOUR	25.85	21.38	11.25	1.15	693.4	5519.2	AP
1-HOUR	35.56	23.06	12.28	0.36	693.4	5515.3	CABIN
1-HOUR	255.79	243.87	112.97	1.00	685.0	5514.3	R2
1-HOUR	35.47	22.94	12.24	0.35	693.4	5515.3	R5
1-HOUR	408.25	321.70	95.60	1.05	687.7	5510.2	R11

NO2 - Concentration: [ug/m**3]							
Average Period	100th Percentile (1st Highest)	99.9th Percentile	98th Percentile	Average	X [km]	Y [km]	Receptor ID
MPOI							
1-HOUR	1263.10	1055.40	448.84	32.28	678.0	5518.0	644
24-HOUR	337.22	-	-	-	678.0	5518.0	644
720-HOUR	77.33	-	-	-	679.0	5519.0	716
8760-HOUR	60.21	-	-	-	679.0	5518.0	645
24-HOUR	1.61	-	-	-	690.1	5588.0	CARTWRT
24-HOUR	4.08	-	-	-	696.4	5548.3	CHIMNEY
24-HOUR	2.21	-	-	-	695.8	5573.6	BB_RANCH
24-HOUR	27.69	-	-	-	685.3	5523.3	RH_CRK
24-HOUR	3.34	-	-	-	672.4	5573.6	CTRT_CRK
24-HOUR	6.12	-	-	-	672.8	5547.1	OLDM_RF
24-HOUR	95.29	-	-	-	683.1	5552.9	LVST_F
24-HOUR	20.96	-	-	-	683.4	5556.6	PLT_MC
24-HOUR	2.21	-	-	-	695.8	5573.6	C_GARDN
24-HOUR	2.09	-	-	-	696.7	5576.4	S_GARDN
24-HOUR	2.44	-	-	-	700.6	5565.0	RLND_MB
24-HOUR	3.76	-	-	-	694.7	5555.1	R_BLAKE
24-HOUR	3.95	-	-	-	693.2	5556.8	B_RANSOM
24-HOUR	3.38	-	-	-	699.4	5555.2	RCKP_PLC
24-HOUR	3.81	-	-	-	697.4	5548.7	S_HARVEY
24-HOUR	3.85	-	-	-	697.6	5550.6	R_DAVIS
24-HOUR	4.15	-	-	-	696.5	5549.3	RESIDEN
24-HOUR	4.03	-	-	-	696.8	5549.5	COCHLAN
24-HOUR	67.38	-	-	-	683.8	5544.9	N_RCKP
24-HOUR	5.96	-	-	-	671.4	5550.3	NW_RCKP
24-HOUR	24.03	-	-	-	686.7	5535.8	S_RCKP
24-HOUR	5.31	-	-	-	695.4	5543.1	E_RCKP
24-HOUR	12.32	-	-	-	676.7	5540.5	W_RCKP
24-HOUR	3.34	-	-	-	705.0	5535.6	WLDRN_N
24-HOUR	5.29	-	-	-	705.9	5523.4	WLDRN_S
24-HOUR	4.74	-	-	-	697.2	5528.8	BOB_BNB
24-HOUR	1.58	-	-	-	705.0	5580.9	BLADE_R
24-HOUR	8.70	-	-	-	687.9	5528.5	LVG_GAP
24-HOUR	36.42	-	-	-	683.8	5536.1	OM_RVR
24-HOUR	35.39	-	-	-	682.4	5537.3	ATRM_EN
24-HOUR	12.57	-	-	-	679.9	5540.0	CBN_RDG
24-HOUR	13.87	-	-	-	676.2	5544.3	CR_HM_EN
24-HOUR	10.75	-	-	-	675.0	5545.1	HNYMNCRK
24-HOUR	75.45	-	-	-	685.8	5539.1	BLADE_C
24-HOUR	69.58	-	-	-	686.0	5539.1	MCLY_CRK
24-HOUR	6.60	-	-	-	696.5	5525.0	DENNIS
24-HOUR	6.07	-	-	-	687.5	5551.0	PLT_NE
24-HOUR	8.83	-	-	-	679.1	5564.1	PLT_NW
24-HOUR	36.07	-	-	-	681.9	5545.5	PLT_SW
24-HOUR	7.91	-	-	-	687.3	5545.7	PLT_SE
24-HOUR	3.61	-	-	-	698.3	5548.5	RCKP_E
24-HOUR	3.04	-	-	-	672.1	5577.0	RCKP_NE
24-HOUR	1.40	-	-	-	659.4	5576.5	RCKP_NW
24-HOUR	45.24	-	-	-	673.2	5534.9	RCKP_SW
24-HOUR	3.09	-	-	-	699.6	5536.4	RCKP_SE
24-HOUR	1.28	-	-	-	714.5	5579.1	PLATEAU
24-HOUR	10.86	-	-	-	693.4	5519.2	AP
24-HOUR	7.80	-	-	-	693.4	5515.3	CABIN
24-HOUR	101.15	-	-	-	685.0	5514.3	R2
24-HOUR	7.79	-	-	-	693.4	5515.3	R5
24-HOUR	65.55	-	-	-	687.7	5510.2	R11

NO2 - Concentration: [ug/m**3]							
Average Period	100th Percentile (1st Highest)	99.9th Percentile	98th Percentile	Average	X [km]	Y [km]	Receptor ID
MPOI							
1-HOUR	1263.10	1055.40	448.84	32.28	678.0	5518.0	644
24-HOUR	337.22	-	-	-	678.0	5518.0	644
720-HOUR	77.33	-	-	-	679.0	5519.0	716
8760-HOUR	60.21	-	-	-	679.0	5518.0	645
720-HOUR	0.23	-	-	-	690.1	5588.0	CARTWRT
720-HOUR	1.20	-	-	-	696.4	5548.3	CHIMNEY
720-HOUR	0.31	-	-	-	695.8	5573.6	BB_RANCH
720-HOUR	5.63	-	-	-	685.3	5523.3	RH_CRK
720-HOUR	0.35	-	-	-	672.4	5573.6	CTRT_CRK
720-HOUR	0.92	-	-	-	672.8	5547.1	OLDM_RF
720-HOUR	16.02	-	-	-	683.1	5552.9	LVST_F
720-HOUR	4.01	-	-	-	683.4	5556.6	PLT_MC
720-HOUR	0.31	-	-	-	695.8	5573.6	C_GARDN
720-HOUR	0.28	-	-	-	696.7	5576.4	S_GARDN
720-HOUR	0.55	-	-	-	700.6	5565.0	RLND_MB
720-HOUR	1.21	-	-	-	694.7	5555.1	R_BLAKE
720-HOUR	1.19	-	-	-	693.2	5556.8	B_RANSOM
720-HOUR	1.03	-	-	-	699.4	5555.2	RCKP_PLC
720-HOUR	1.13	-	-	-	697.4	5548.7	S_HARVEY
720-HOUR	1.03	-	-	-	697.6	5550.6	R_DAVIS
720-HOUR	1.10	-	-	-	696.5	5549.3	RESIDEN
720-HOUR	1.09	-	-	-	696.8	5549.5	COCHLAN
720-HOUR	12.36	-	-	-	683.8	5544.9	N_RCKP
720-HOUR	0.63	-	-	-	671.4	5550.3	NW_RCKP
720-HOUR	4.65	-	-	-	686.7	5535.8	S_RCKP
720-HOUR	1.94	-	-	-	695.4	5543.1	E_RCKP
720-HOUR	2.04	-	-	-	676.7	5540.5	W_RCKP
720-HOUR	1.02	-	-	-	705.0	5535.6	WLDRN_N
720-HOUR	2.21	-	-	-	705.9	5523.4	WLDRN_S
720-HOUR	1.50	-	-	-	697.2	5528.8	BOB_BNB
720-HOUR	0.22	-	-	-	705.0	5580.9	BLADE_R
720-HOUR	1.96	-	-	-	687.9	5528.5	LVG_GAP
720-HOUR	5.50	-	-	-	683.8	5536.1	OM_RVR
720-HOUR	5.60	-	-	-	682.4	5537.3	ATRM_EN
720-HOUR	2.77	-	-	-	679.9	5540.0	CBN_RDG
720-HOUR	1.98	-	-	-	676.2	5544.3	CR_HM_EN
720-HOUR	1.45	-	-	-	675.0	5545.1	HNYMNCRK
720-HOUR	12.52	-	-	-	685.8	5539.1	BLADE_C
720-HOUR	11.64	-	-	-	686.0	5539.1	MCLY_CRK
720-HOUR	2.12	-	-	-	696.5	5525.0	DENNIS
720-HOUR	2.18	-	-	-	687.5	5551.0	PLT_NE
720-HOUR	0.85	-	-	-	679.1	5564.1	PLT_NW
720-HOUR	9.69	-	-	-	681.9	5545.5	PLT_SW
720-HOUR	2.56	-	-	-	687.3	5545.7	PLT_SE
720-HOUR	1.14	-	-	-	698.3	5548.5	RCKP_E
720-HOUR	0.30	-	-	-	672.1	5577.0	RCKP_NE
720-HOUR	0.17	-	-	-	659.4	5576.5	RCKP_NW
720-HOUR	8.51	-	-	-	673.2	5534.9	RCKP_SW
720-HOUR	1.23	-	-	-	699.6	5536.4	RCKP_SE
720-HOUR	0.26	-	-	-	714.5	5579.1	PLATEAU
720-HOUR	3.72	-	-	-	693.4	5519.2	AP
720-HOUR	2.33	-	-	-	693.4	5515.3	CABIN
720-HOUR	16.35	-	-	-	685.0	5514.3	R2
720-HOUR	2.32	-	-	-	693.4	5515.3	R5
720-HOUR	12.23	-	-	-	687.7	5510.2	R11

NO2 - Concentration: [ug/m**3]							
Average Period	100th Percentile (1st Highest)	99.9th Percentile	98th Percentile	Average	X [km]	Y [km]	Receptor ID
MPOI							
1-HOUR	1263.10	1055.40	448.84	32.28	678.0	5518.0	644
24-HOUR	337.22	-	-	-	678.0	5518.0	644
720-HOUR	77.33	-	-	-	679.0	5519.0	716
8760-HOUR	60.21	-	-	-	679.0	5518.0	645
8760-HOUR	0.10	-	-	-	690.1	5588.0	CARTWRT
8760-HOUR	0.85	-	-	-	696.4	5548.3	CHIMNEY
8760-HOUR	0.16	-	-	-	695.8	5573.6	BB_RANCH
8760-HOUR	3.06	-	-	-	685.3	5523.3	RH_CRK
8760-HOUR	0.12	-	-	-	672.4	5573.6	CTRT_CRK
8760-HOUR	0.53	-	-	-	672.8	5547.1	OLDM_RF
8760-HOUR	10.38	-	-	-	683.1	5552.9	LVST_F
8760-HOUR	1.80	-	-	-	683.4	5556.6	PLT_MC
8760-HOUR	0.16	-	-	-	695.8	5573.6	C_GARDN
8760-HOUR	0.14	-	-	-	696.7	5576.4	S_GARDN
8760-HOUR	0.30	-	-	-	700.6	5565.0	RLND_MB
8760-HOUR	0.84	-	-	-	694.7	5555.1	R_BLAKE
8760-HOUR	0.76	-	-	-	693.2	5556.8	B_RANSOM
8760-HOUR	0.68	-	-	-	699.4	5555.2	RCKP_PLC
8760-HOUR	0.80	-	-	-	697.4	5548.7	S_HARVEY
8760-HOUR	0.75	-	-	-	697.6	5550.6	R_DAVIS
8760-HOUR	0.80	-	-	-	696.5	5549.3	RESIDEN
8760-HOUR	0.79	-	-	-	696.8	5549.5	COCHLAN
8760-HOUR	6.02	-	-	-	683.8	5544.9	N_RCKP
8760-HOUR	0.37	-	-	-	671.4	5550.3	NW_RCKP
8760-HOUR	2.63	-	-	-	686.7	5535.8	S_RCKP
8760-HOUR	1.46	-	-	-	695.4	5543.1	E_RCKP
8760-HOUR	1.26	-	-	-	676.7	5540.5	W_RCKP
8760-HOUR	0.79	-	-	-	705.0	5535.6	WLDRN_N
8760-HOUR	1.44	-	-	-	705.9	5523.4	WLDRN_S
8760-HOUR	1.06	-	-	-	697.2	5528.8	BOB_BNB
8760-HOUR	0.12	-	-	-	705.0	5580.9	BLADE_R
8760-HOUR	1.35	-	-	-	687.9	5528.5	LVG_GAP
8760-HOUR	3.84	-	-	-	683.8	5536.1	OM_RVR
8760-HOUR	3.67	-	-	-	682.4	5537.3	ATRM_EN
8760-HOUR	1.68	-	-	-	679.9	5540.0	CBN_RDG
8760-HOUR	1.19	-	-	-	676.2	5544.3	CR_HM_EN
8760-HOUR	0.86	-	-	-	675.0	5545.1	HNYMNCRK
8760-HOUR	6.92	-	-	-	685.8	5539.1	BLADE_C
8760-HOUR	6.47	-	-	-	686.0	5539.1	MCLY_CRK
8760-HOUR	1.61	-	-	-	696.5	5525.0	DENNIS
8760-HOUR	1.76	-	-	-	687.5	5551.0	PLT_NE
8760-HOUR	0.33	-	-	-	679.1	5564.1	PLT_NW
8760-HOUR	5.85	-	-	-	681.9	5545.5	PLT_SW
8760-HOUR	1.94	-	-	-	687.3	5545.7	PLT_SE
8760-HOUR	0.80	-	-	-	698.3	5548.5	RCKP_E
8760-HOUR	0.10	-	-	-	672.1	5577.0	RCKP_NE
8760-HOUR	0.06	-	-	-	659.4	5576.5	RCKP_NW
8760-HOUR	5.18	-	-	-	673.2	5534.9	RCKP_SW
8760-HOUR	0.91	-	-	-	699.6	5536.4	RCKP_SE
8760-HOUR	0.14	-	-	-	714.5	5579.1	PLATEAU
8760-HOUR	2.39	-	-	-	693.4	5519.2	AP
8760-HOUR	1.60	-	-	-	693.4	5515.3	CABIN
8760-HOUR	8.93	-	-	-	685.0	5514.3	R2
8760-HOUR	1.59	-	-	-	693.4	5515.3	R5
8760-HOUR	7.59	-	-	-	687.7	5510.2	R11

Results Summary							
SO2 - Dry Deposition: [ug/m**2/s]							
Average Period	Rank	Peak	Year, Julian Day, Start Hour	X [km]	Y [km]	Receptor	Receptor Type
8760-HOUR	1	4.9790E-003		679.001	5519.000	716	DISCRETE
SO2 - Wet Deposition: [ug/m**2/s]							
Average Period	Rank	Peak	Year, Julian Day, Start Hour	X [km]	Y [km]	Receptor	Receptor Type
8760-HOUR	1	1.3137E-004		679.001	5519.000	716	DISCRETE
SO4 - Dry Deposition: [ug/m**2/s]							
Average Period	Rank	Peak	Year, Julian Day, Start Hour	X [km]	Y [km]	Receptor	Receptor Type
8760-HOUR	1	1.9954E-007		679.001	5519.000	716	DISCRETE
SO4 - Wet Deposition: [ug/m**2/s]							
Average Period	Rank	Peak	Year, Julian Day, Start Hour	X [km]	Y [km]	Receptor	Receptor Type
8760-HOUR	1	3.3599E-006		679.001	5519.000	716	DISCRETE
NO - Dry Deposition: [ug/m**2/s]							
Average Period	Rank	Peak	Year, Julian Day, Start Hour	X [km]	Y [km]	Receptor	Receptor Type
8760-HOUR	1	2.9431E-002		678.001	5516.000	502	DISCRETE
NO2 - Dry Deposition: [ug/m**2/s]							
Average Period	Rank	Peak	Year, Julian Day, Start Hour	X [km]	Y [km]	Receptor	Receptor Type
8760-HOUR	1	2.6766E-001		679.001	5519.000	716	DISCRETE
HNO3 - Dry Deposition: [ug/m**2/s]							
Average Period	Rank	Peak	Year, Julian Day, Start Hour	X [km]	Y [km]	Receptor	Receptor Type
8760-HOUR	1	6.6769E-004		684.001	5541.000	2283	DISCRETE
HNO3 - Wet Deposition: [ug/m**2/s]							
Average Period	Rank	Peak	Year, Julian Day, Start Hour	X [km]	Y [km]	Receptor	Receptor Type
8760-HOUR	1	2.0399E-004		685.001	5518.000	651	DISCRETE
NO3 - Dry Deposition: [ug/m**2/s]							
Average Period	Rank	Peak	Year, Julian Day, Start Hour	X [km]	Y [km]	Receptor	Receptor Type
8760-HOUR	1	7.0122E-005		684.001	5541.000	2283	DISCRETE
NO3 - Wet Deposition: [ug/m**2/s]							
Average Period	Rank	Peak	Year, Julian Day, Start Hour	X [km]	Y [km]	Receptor	Receptor Type
8760-HOUR	1	1.1584E-003		681.001	5551.000	2989	DISCRETE

SO2 8760 HOUR AVERAGE DRY DEPOSITION VALUES AT EACH RECEPTOR (ug/m**2/s)			
CARTWRT	690.147	5588.005	1.509E-06
CHIMNEY	696.433	5548.251	2.314E-05
BB_RANCH	695.826	5573.604	2.872E-06
RH_CRK	685.317	5523.281	7.047E-05
CTRT_CRK	672.367	5573.601	3.354E-06
OLDM_RF	672.827	5547.071	1.225E-05
LVST_F	683.129	5552.896	0.0003164
PLT_MC	683.368	5556.613	3.995E-05
C_GARDN	695.848	5573.64	2.861E-06
S_GARDN	696.699	5576.381	2.256E-06
RLND_MB	700.645	5564.964	4.834E-06
R_BLAKE	694.711	5555.109	1.788E-05
B_RANSOM	693.212	5556.837	1.748E-05
RCKP_PLC	699.359	5555.178	1.175E-05
S_HARVEY	697.429	5548.723	2.112E-05
R_DAVIS	697.558	5550.64	1.728E-05
RESIDEN	696.456	5549.347	2.13E-05
COCHLAN	696.808	5549.509	2.045E-05
N_RCKP	683.776	5544.942	0.0001412
NW_RCKP	671.414	5550.313	8.845E-06
S_RCKP	686.731	5535.803	4.565E-05
E_RCKP	695.444	5543.061	3.92E-05
W_RCKP	676.654	5540.48	2.504E-05
WLDRN_N	704.966	5535.607	1.196E-05
WLDRN_S	705.908	5523.353	1.528E-05
BOB_BNB	697.212	5528.848	1.624E-05
BLADE_R	704.994	5580.872	1.433E-06
LVG_GAP	687.859	5528.53	2.726E-05
OM_RVR	683.841	5536.05	6.832E-05
ATRM_EN	682.393	5537.348	7.323E-05
CBN_RDG	679.948	5540.003	3.795E-05
CR_HM_EN	676.24	5544.334	2.282E-05
HNYMNCRK	675.037	5545.114	1.812E-05
BLADE_C	685.82	5539.096	0.0001052
MCLY_CRK	685.986	5539.089	9.739E-05
DENNIS	696.528	5524.989	2.992E-05
PLT_NE	687.504	5550.972	3.646E-05
PLT_NW	679.139	5564.096	7.774E-06
PLT_SW	681.937	5545.506	0.0001087
PLT_SE	687.33	5545.703	4.93E-05
RCKP_E	698.281	5548.469	2.111E-05
RCKP_NE	672.08	5576.952	2.921E-06
RCKP_NW	659.402	5576.545	1.347E-06
RCKP_SW	673.238	5534.92	8.919E-05
RCKP_SE	699.604	5536.393	1.828E-05
PLATEAU	714.525	5579.088	1.653E-06
AP	693.35	5519.213	5.206E-05
CABIN	693.409	5515.331	3.166E-05
R2	685.018	5514.27	0.0002645
R5	693.409	5515.331	3.147E-05
R11	687.682	5510.209	0.0001914

SO2 8760 HOUR AVERAGE Wet DEPOSITION VALUES AT EACH RECEPTOR (ug/m**2/s)			
CARTWRT	690.147	5588.005	1.54E-06
CHIMNEY	696.433	5548.251	6.528E-06
BB_RANCH	695.826	5573.604	2.356E-06
RH_CRK	685.317	5523.281	1.446E-05
CTRT_CRK	672.367	5573.601	3.562E-06
OLDM_RF	672.827	5547.071	9.328E-06
LVST_F	683.129	5552.896	2.491E-05
PLT_MC	683.368	5556.613	1.022E-05
C_GARDN	695.848	5573.64	2.35E-06
S_GARDN	696.699	5576.381	2.009E-06
RLND_MB	700.645	5564.964	3.222E-06
R_BLAKE	694.711	5555.109	6.513E-06
B_RANSOM	693.212	5556.837	7.136E-06
RCKP_PLC	699.359	5555.178	5.359E-06
S_HARVEY	697.429	5548.723	6.19E-06
R_DAVIS	697.558	5550.64	5.718E-06
RESIDEN	696.456	5549.347	6.157E-06
COCHLAN	696.808	5549.509	6.055E-06
N_RCKP	683.776	5544.942	1.825E-05
NW_RCKP	671.414	5550.313	8.414E-06
S_RCKP	686.731	5535.803	1.12E-05
E_RCKP	695.444	5543.061	7.955E-06
W_RCKP	676.654	5540.48	1.251E-05
WLDRN_N	704.966	5535.607	5.854E-06
WLDRN_S	705.908	5523.353	6.966E-06
BOB_BNB	697.212	5528.848	7.393E-06
BLADE_R	704.994	5580.872	1.19E-06
LVG_GAP	687.859	5528.53	9.745E-06
OM_RVR	683.841	5536.05	1.341E-05
ATRM_EN	682.393	5537.348	1.678E-05
CBN_RDG	679.948	5540.003	1.616E-05
CR_HM_EN	676.24	5544.334	1.129E-05
HNYMNCRK	675.037	5545.114	1.029E-05
BLADE_C	685.82	5539.096	1.651E-05
MCLY_CRK	685.986	5539.089	1.592E-05
DENNIS	696.528	5524.989	8.311E-06
PLT_NE	687.504	5550.972	9.62E-06
PLT_NW	679.139	5564.096	6.041E-06
PLT_SW	681.937	5545.506	1.768E-05
PLT_SE	687.33	5545.703	1.172E-05
RCKP_E	698.281	5548.469	6.129E-06
RCKP_NE	672.08	5576.952	3.166E-06
RCKP_NW	659.402	5576.545	2.51E-06
RCKP_SW	673.238	5534.92	1.673E-05
RCKP_SE	699.604	5536.393	6.628E-06
PLATEAU	714.525	5579.088	1.108E-06
AP	693.35	5519.213	1.043E-05
CABIN	693.409	5515.331	1.05E-05
R2	685.018	5514.27	1.731E-05
R5	693.409	5515.331	1.05E-05
R11	687.682	5510.209	1.985E-05

SO4 8760 HOUR AVERAGE DRY DEPOSITION VALUES AT EACH RECEPTOR (ug/m**2/s)			
CARTWRT	690.147	5588.005	5.494E-09
CHIMNEY	696.433	5548.251	1.584E-08
BB_RANCH	695.826	5573.604	7.51E-09
RH_CRK	685.317	5523.281	2.048E-08
CTRT_CRK	672.367	5573.601	6.592E-09
OLDM_RF	672.827	5547.071	1.017E-08
LVST_F	683.129	5552.896	3.439E-08
PLT_MC	683.368	5556.613	1.49E-08
C_GARDN	695.848	5573.64	7.501E-09
S_GARDN	696.699	5576.381	6.92E-09
RLND_MB	700.645	5564.964	8.622E-09
R_BLAKE	694.711	5555.109	1.274E-08
B_RANSOM	693.212	5556.837	1.265E-08
RCKP_PLC	699.359	5555.178	1.122E-08
S_HARVEY	697.429	5548.723	1.462E-08
R_DAVIS	697.558	5550.64	1.311E-08
RESIDEN	696.456	5549.347	1.518E-08
COCHLAN	696.808	5549.509	1.464E-08
N_RCKP	683.776	5544.942	2.379E-08
NW_RCKP	671.414	5550.313	9.028E-09
S_RCKP	686.731	5535.803	1.629E-08
E_RCKP	695.444	5543.061	1.7E-08
W_RCKP	676.654	5540.48	1.329E-08
WLDRN_N	704.966	5535.607	1.125E-08
WLDRN_S	705.908	5523.353	1.303E-08
BOB_BNB	697.212	5528.848	1.23E-08
BLADE_R	704.994	5580.872	5.712E-09
LVG_GAP	687.859	5528.53	1.385E-08
OM_RVR	683.841	5536.05	1.97E-08
ATRM_EN	682.393	5537.348	2.048E-08
CBN_RDG	679.948	5540.003	1.625E-08
CR_HM_EN	676.24	5544.334	1.251E-08
HNYMNCRK	675.037	5545.114	1.176E-08
BLADE_C	685.82	5539.096	2.117E-08
MCLY_CRK	685.986	5539.089	2.06E-08
DENNIS	696.528	5524.989	1.622E-08
PLT_NE	687.504	5550.972	1.459E-08
PLT_NW	679.139	5564.096	9.676E-09
PLT_SW	681.937	5545.506	2.125E-08
PLT_SE	687.33	5545.703	1.758E-08
RCKP_E	698.281	5548.469	1.457E-08
RCKP_NE	672.08	5576.952	6.226E-09
RCKP_NW	659.402	5576.545	3.72E-09
RCKP_SW	673.238	5534.92	1.615E-08
RCKP_SE	699.604	5536.393	1.223E-08
PLATEAU	714.525	5579.088	5.727E-09
AP	693.35	5519.213	2.082E-08
CABIN	693.409	5515.331	1.498E-08
R2	685.018	5514.27	2.514E-08
R5	693.409	5515.331	1.495E-08
R11	687.682	5510.209	2.367E-08

SO4 8760 HOUR AVERAGE WET DEPOSITION VALUES AT EACH RECEPTOR (ug/m**2/s)			
CARTWRT	690.147	5588.005	6.86E-07
CHIMNEY	696.433	5548.251	1.609E-06
BB_RANCH	695.826	5573.604	1.024E-06
RH_CRK	685.317	5523.281	1.757E-06
CTRT_CRK	672.367	5573.601	1.112E-06
OLDM_RF	672.827	5547.071	1.752E-06
LVST_F	683.129	5552.896	2.291E-06
PLT_MC	683.368	5556.613	2.012E-06
C_GARDN	695.848	5573.64	1.022E-06
S_GARDN	696.699	5576.381	9E-07
RLND_MB	700.645	5564.964	1.186E-06
R_BLAKE	694.711	5555.109	1.68E-06
B_RANSOM	693.212	5556.837	1.745E-06
RCKP_PLC	699.359	5555.178	1.535E-06
S_HARVEY	697.429	5548.723	1.583E-06
R_DAVIS	697.558	5550.64	1.568E-06
RESIDEN	696.456	5549.347	1.593E-06
COCHLAN	696.808	5549.509	1.585E-06
N_RCKP	683.776	5544.942	2.251E-06
NW_RCKP	671.414	5550.313	1.726E-06
S_RCKP	686.731	5535.803	1.744E-06
E_RCKP	695.444	5543.061	1.684E-06
W_RCKP	676.654	5540.48	1.937E-06
WLDRN_N	704.966	5535.607	1.543E-06
WLDRN_S	705.908	5523.353	1.538E-06
BOB_BNB	697.212	5528.848	1.584E-06
BLADE_R	704.994	5580.872	5.715E-07
LVG_GAP	687.859	5528.53	1.589E-06
OM_RVR	683.841	5536.05	1.75E-06
ATRM_EN	682.393	5537.348	1.837E-06
CBN_RDG	679.948	5540.003	2.031E-06
CR_HM_EN	676.24	5544.334	1.861E-06
HNYMNCRK	675.037	5545.114	1.817E-06
BLADE_C	685.82	5539.096	1.96E-06
MCLY_CRK	685.986	5539.089	1.954E-06
DENNIS	696.528	5524.989	1.546E-06
PLT_NE	687.504	5550.972	1.951E-06
PLT_NW	679.139	5564.096	1.589E-06
PLT_SW	681.937	5545.506	2.141E-06
PLT_SE	687.33	5545.703	2.017E-06
RCKP_E	698.281	5548.469	1.573E-06
RCKP_NE	672.08	5576.952	1.039E-06
RCKP_NW	659.402	5576.545	7.527E-07
RCKP_SW	673.238	5534.92	1.829E-06
RCKP_SE	699.604	5536.393	1.578E-06
PLATEAU	714.525	5579.088	4.756E-07
AP	693.35	5519.213	1.555E-06
CABIN	693.409	5515.331	1.488E-06
R2	685.018	5514.27	1.345E-06
R5	693.409	5515.331	1.488E-06
R11	687.682	5510.209	1.335E-06

NO 8760 HOUR AVERAGE DRY DEPOSITION VALUES AT EACH RECEPTOR (ug/m**2/s)			
CARTWRT	690.147	5588.005	4.733E-06
CHIMNEY	696.433	5548.251	5.614E-05
BB_RANCH	695.826	5573.604	8.653E-06
RH_CRK	685.317	5523.281	0.0001002
CTRT_CRK	672.367	5573.601	1.028E-05
OLDM_RF	672.827	5547.071	3.113E-05
LVST_F	683.129	5552.896	0.0004859
PLT_MC	683.368	5556.613	6.928E-05
C_GARDN	695.848	5573.64	8.621E-06
S_GARDN	696.699	5576.381	6.801E-06
RLND_MB	700.645	5564.964	1.338E-05
R_BLAKE	694.711	5555.109	3.844E-05
B_RANSOM	693.212	5556.837	3.843E-05
RCKP_PLC	699.359	5555.178	2.753E-05
S_HARVEY	697.429	5548.723	5.149E-05
R_DAVIS	697.558	5550.64	4.307E-05
RESIDEN	696.456	5549.347	5.215E-05
COCHLAN	696.808	5549.509	5.033E-05
N_RCKP	683.776	5544.942	0.0001679
NW_RCKP	671.414	5550.313	2.344E-05
S_RCKP	686.731	5535.803	7.603E-05
E_RCKP	695.444	5543.061	7.421E-05
W_RCKP	676.654	5540.48	6.533E-05
WLDRN_N	704.966	5535.607	3.069E-05
WLDRN_S	705.908	5523.353	2.82E-05
BOB_BNB	697.212	5528.848	3.801E-05
BLADE_R	704.994	5580.872	4.183E-06
LVG_GAP	687.859	5528.53	5.401E-05
OM_RVR	683.841	5536.05	9.492E-05
ATRM_EN	682.393	5537.348	0.000131
CBN_RDG	679.948	5540.003	0.0001052
CR_HM_EN	676.24	5544.334	5.363E-05
HNYMNCRK	675.037	5545.114	4.398E-05
BLADE_C	685.82	5539.096	0.0001778
MCLY_CRK	685.986	5539.089	0.000166
DENNIS	696.528	5524.989	5.938E-05
PLT_NE	687.504	5550.972	8.23E-05
PLT_NW	679.139	5564.096	2.13E-05
PLT_SW	681.937	5545.506	0.0002025
PLT_SE	687.33	5545.703	0.0001056
RCKP_E	698.281	5548.469	5.031E-05
RCKP_NE	672.08	5576.952	9.302E-06
RCKP_NW	659.402	5576.545	4.426E-06
RCKP_SW	673.238	5534.92	0.0001178
RCKP_SE	699.604	5536.393	4.224E-05
PLATEAU	714.525	5579.088	4.827E-06
AP	693.35	5519.213	0.0001143
CABIN	693.409	5515.331	7.923E-05
R2	685.018	5514.27	0.0002578
R5	693.409	5515.331	7.935E-05
R11	687.682	5510.209	0.0003385

NO2 8760 HOUR AVERAGE DRY DEPOSITION VALUES AT EACH RECEPTOR (ug/m**2/s)			
CARTWRT	690.147	5588.005	0.0001437
CHIMNEY	696.433	5548.251	0.0025883
BB_RANCH	695.826	5573.604	0.0002794
RH_CRK	685.317	5523.281	0.0071054
CTRT_CRK	672.367	5573.601	0.0003365
OLDM_RF	672.827	5547.071	0.0014449
LVST_F	683.129	5552.896	0.030004
PLT_MC	683.368	5556.613	0.0041139
C_GARDN	695.848	5573.64	0.0002783
S_GARDN	696.699	5576.381	0.0002182
RLND_MB	700.645	5564.964	0.0004875
R_BLAKE	694.711	5555.109	0.0019192
B_RANSOM	693.212	5556.837	0.0018264
RCKP_PLC	699.359	5555.178	0.0012529
S_HARVEY	697.429	5548.723	0.0023625
R_DAVIS	697.558	5550.64	0.0019158
RESIDEN	696.456	5549.347	0.0023792
COCHLAN	696.808	5549.509	0.0022828
N_RCKP	683.776	5544.942	0.015283
NW_RCKP	671.414	5550.313	0.0010158
S_RCKP	686.731	5535.803	0.0055635
E_RCKP	695.444	5543.061	0.0044207
W_RCKP	676.654	5540.48	0.002929
WLDRN_N	704.966	5535.607	0.0012677
WLDRN_S	705.908	5523.353	0.0016348
BOB_BNB	697.212	5528.848	0.0016998
BLADE_R	704.994	5580.872	0.0001398
LVG_GAP	687.859	5528.53	0.0029819
OM_RVR	683.841	5536.05	0.0083483
ATRM_EN	682.393	5537.348	0.0089282
CBN_RDG	679.948	5540.003	0.0047489
CR_HM_EN	676.24	5544.334	0.0030728
HNYMNCRK	675.037	5545.114	0.0023057
BLADE_C	685.82	5539.096	0.014323
MCLY_CRK	685.986	5539.089	0.013169
DENNIS	696.528	5524.989	0.00305
PLT_NE	687.504	5550.972	0.004228
PLT_NW	679.139	5564.096	0.0007774
PLT_SW	681.937	5545.506	0.015925
PLT_SE	687.33	5545.703	0.0052412
RCKP_E	698.281	5548.469	0.0023582
RCKP_NE	672.08	5576.952	0.0002894
RCKP_NW	659.402	5576.545	0.0001358
RCKP_SW	673.238	5534.92	0.0096044
RCKP_SE	699.604	5536.393	0.0019958
PLATEAU	714.525	5579.088	0.0001647
AP	693.35	5519.213	0.0059323
CABIN	693.409	5515.331	0.003756
R2	685.018	5514.27	0.023129
R5	693.409	5515.331	0.0037458
R11	687.682	5510.209	0.017144

HNO3 8760 HOUR AVERAGE DRY DEPOSITION VALUES AT EACH RECEPTOR (ug/m**2/s)			
CARTWRT	690.147	5588.005	2.13E-05
CHIMNEY	696.433	5548.251	5.89E-05
BB_RANCH	695.826	5573.604	3.29E-05
RH_CRK	685.317	5523.281	8.651E-05
CTRT_CRK	672.367	5573.601	1.906E-05
OLDM_RF	672.827	5547.071	3.435E-05
LVST_F	683.129	5552.896	0.0001059
PLT_MC	683.368	5556.613	6.193E-05
C_GARDN	695.848	5573.64	3.284E-05
S_GARDN	696.699	5576.381	2.893E-05
RLND_MB	700.645	5564.964	3.741E-05
R_BLAKE	694.711	5555.109	5.104E-05
B_RANSOM	693.212	5556.837	5.129E-05
RCKP_PLC	699.359	5555.178	4.742E-05
S_HARVEY	697.429	5548.723	5.738E-05
R_DAVIS	697.558	5550.64	5.491E-05
RESIDEN	696.456	5549.347	5.808E-05
COCHLAN	696.808	5549.509	5.743E-05
N_RCKP	683.776	5544.942	9.243E-05
NW_RCKP	671.414	5550.313	2.914E-05
S_RCKP	686.731	5535.803	6.123E-05
E_RCKP	695.444	5543.061	6.021E-05
W_RCKP	676.654	5540.48	5.66E-05
WLDRN_N	704.966	5535.607	4.377E-05
WLDRN_S	705.908	5523.353	3.505E-05
BOB_BNB	697.212	5528.848	4.424E-05
BLADE_R	704.994	5580.872	2.092E-05
LVG_GAP	687.859	5528.53	5.39E-05
OM_RVR	683.841	5536.05	6.742E-05
ATRM_EN	682.393	5537.348	7.054E-05
CBN_RDG	679.948	5540.003	6.558E-05
CR_HM_EN	676.24	5544.334	4.669E-05
HNYMNCRK	675.037	5545.114	4.227E-05
BLADE_C	685.82	5539.096	7.721E-05
MCLY_CRK	685.986	5539.089	7.506E-05
DENNIS	696.528	5524.989	5.178E-05
PLT_NE	687.504	5550.972	5.939E-05
PLT_NW	679.139	5564.096	3.534E-05
PLT_SW	681.937	5545.506	7.84E-05
PLT_SE	687.33	5545.703	6.912E-05
RCKP_E	698.281	5548.469	5.667E-05
RCKP_NE	672.08	5576.952	1.774E-05
RCKP_NW	659.402	5576.545	7.125E-06
RCKP_SW	673.238	5534.92	5.681E-05
RCKP_SE	699.604	5536.393	4.699E-05
PLATEAU	714.525	5579.088	2.088E-05
AP	693.35	5519.213	6.106E-05
CABIN	693.409	5515.331	4.671E-05
R2	685.018	5514.27	8.215E-05
R5	693.409	5515.331	4.674E-05
R11	687.682	5510.209	0.0001058

HNO ₃ 8760 HOUR AVERAGE WET DEPOSITION VALUES AT EACH RECEPTOR (ug/m**2/s)			
CARTWRT	690.147	5588.005	5.725E-05
CHIMNEY	696.433	5548.251	0.0001185
BB_RANCH	695.826	5573.604	8.454E-05
RH_CRK	685.317	5523.281	0.0001161
CTRT_CRK	672.367	5573.601	4.009E-05
OLDM_RF	672.827	5547.071	6.322E-05
LVST_F	683.129	5552.896	0.0001257
PLT_MC	683.368	5556.613	0.0001096
C_GARDN	695.848	5573.64	8.444E-05
S_GARDN	696.699	5576.381	7.731E-05
RLND_MB	700.645	5564.964	9.947E-05
R_BLAKE	694.711	5555.109	0.0001178
B_RANSOM	693.212	5556.837	0.0001182
RCKP_PLC	699.359	5555.178	0.0001199
S_HARVEY	697.429	5548.723	0.0001183
R_DAVIS	697.558	5550.64	0.0001175
RESIDEN	696.456	5549.347	0.0001171
COCHLAN	696.808	5549.509	0.0001172
N_RCKP	683.776	5544.942	0.0001355
NW_RCKP	671.414	5550.313	6.027E-05
S_RCKP	686.731	5535.803	0.0001166
E_RCKP	695.444	5543.061	0.0001259
W_RCKP	676.654	5540.48	8.234E-05
WLDRN_N	704.966	5535.607	0.0001348
WLDRN_S	705.908	5523.353	0.0001406
BOB_BNB	697.212	5528.848	0.0001262
BLADE_R	704.994	5580.872	5.742E-05
LVG_GAP	687.859	5528.53	0.0001045
OM_RVR	683.841	5536.05	0.0001105
ATRM_EN	682.393	5537.348	0.0001124
CBN_RDG	679.948	5540.003	0.0001042
CR_HM_EN	676.24	5544.334	7.714E-05
HNYMNCRK	675.037	5545.114	7.168E-05
BLADE_C	685.82	5539.096	0.0001289
MCLY_CRK	685.986	5539.089	0.0001287
DENNIS	696.528	5524.989	0.0001245
PLT_NE	687.504	5550.972	0.0001204
PLT_NW	679.139	5564.096	7.172E-05
PLT_SW	681.937	5545.506	0.0001228
PLT_SE	687.33	5545.703	0.0001265
RCKP_E	698.281	5548.469	0.0001191
RCKP_NE	672.08	5576.952	3.839E-05
RCKP_NW	659.402	5576.545	1.885E-05
RCKP_SW	673.238	5534.92	7.267E-05
RCKP_SE	699.604	5536.393	0.0001275
PLATEAU	714.525	5579.088	5.23E-05
AP	693.35	5519.213	0.0001293
CABIN	693.409	5515.331	0.0001315
R2	685.018	5514.27	0.0001065
R5	693.409	5515.331	0.0001315
R11	687.682	5510.209	0.0001063

NO3 8760 HOUR AVERAGE DRY DEPOSITION VALUES AT EACH RECEPTOR (ug/m**2/s)			
CARTWRT	690.147	5588.005	1.399E-06
CHIMNEY	696.433	5548.251	4.269E-06
BB_RANCH	695.826	5573.604	1.965E-06
RH_CRK	685.317	5523.281	9.331E-06
CTRT_CRK	672.367	5573.601	2.233E-06
OLDM_RF	672.827	5547.071	3.913E-06
LVST_F	683.129	5552.896	1.644E-05
PLT_MC	683.368	5556.613	6.221E-06
C_GARDN	695.848	5573.64	1.962E-06
S_GARDN	696.699	5576.381	1.768E-06
RLND_MB	700.645	5564.964	2.247E-06
R_BLAKE	694.711	5555.109	3.596E-06
B_RANSOM	693.212	5556.837	3.651E-06
RCKP_PLC	699.359	5555.178	3.025E-06
S_HARVEY	697.429	5548.723	3.995E-06
R_DAVIS	697.558	5550.64	3.618E-06
RESIDEN	696.456	5549.347	4.083E-06
COCHLAN	696.808	5549.509	3.97E-06
N_RCKP	683.776	5544.942	1.383E-05
NW_RCKP	671.414	5550.313	3.403E-06
S_RCKP	686.731	5535.803	6.518E-06
E_RCKP	695.444	5543.061	4.921E-06
W_RCKP	676.654	5540.48	5.552E-06
WLDRN_N	704.966	5535.607	2.989E-06
WLDRN_S	705.908	5523.353	3.473E-06
BOB_BNB	697.212	5528.848	3.634E-06
BLADE_R	704.994	5580.872	1.362E-06
LVG_GAP	687.859	5528.53	5.106E-06
OM_RVR	683.841	5536.05	8.956E-06
ATRM_EN	682.393	5537.348	9.557E-06
CBN_RDG	679.948	5540.003	6.921E-06
CR_HM_EN	676.24	5544.334	5.363E-06
HNYMNCRK	675.037	5545.114	4.851E-06
BLADE_C	685.82	5539.096	1.095E-05
MCLY_CRK	685.986	5539.089	1.031E-05
DENNIS	696.528	5524.989	4.83E-06
PLT_NE	687.504	5550.972	5.035E-06
PLT_NW	679.139	5564.096	3.278E-06
PLT_SW	681.937	5545.506	1.255E-05
PLT_SE	687.33	5545.703	6.287E-06
RCKP_E	698.281	5548.469	3.958E-06
RCKP_NE	672.08	5576.952	2.095E-06
RCKP_NW	659.402	5576.545	1.288E-06
RCKP_SW	673.238	5534.92	9.11E-06
RCKP_SE	699.604	5536.393	3.476E-06
PLATEAU	714.525	5579.088	1.32E-06
AP	693.35	5519.213	7.235E-06
CABIN	693.409	5515.331	5.246E-06
R2	685.018	5514.27	1.348E-05
R5	693.409	5515.331	5.236E-06
R11	687.682	5510.209	1.274E-05

NO3 8760 HOUR AVERAGE WET DEPOSITION VALUES AT EACH RECEPTOR (ug/m**2/s)			
CARTWRT	690.147	5588.005	2.08E-04
CHIMNEY	696.433	5548.251	5.57E-04
BB_RANCH	695.826	5573.604	3.21E-04
RH_CRK	685.317	5523.281	6.74E-04
CTRT_CRK	672.367	5573.601	4.69E-04
OLDM_RF	672.827	5547.071	8.20E-04
LVST_F	683.129	5552.896	9.29E-04
PLT_MC	683.368	5556.613	8.02E-04
C_GARDN	695.848	5573.64	3.20E-04
S_GARDN	696.699	5576.381	2.73E-04
RLND_MB	700.645	5564.964	3.80E-04
R_BLAKE	694.711	5555.109	5.99E-04
B_RANSOM	693.212	5556.837	6.29E-04
RCKP_PLC	699.359	5555.178	5.21E-04
S_HARVEY	697.429	5548.723	5.45E-04
R_DAVIS	697.558	5550.64	5.42E-04
RESIDEN	696.456	5549.347	5.53E-04
COCHLAN	696.808	5549.509	5.49E-04
N_RCKP	683.776	5544.942	9.06E-04
NW_RCKP	671.414	5550.313	7.97E-04
S_RCKP	686.731	5535.803	6.69E-04
E_RCKP	695.444	5543.061	5.87E-04
W_RCKP	676.654	5540.48	8.54E-04
WLDRN_N	704.966	5535.607	5.20E-04
WLDRN_S	705.908	5523.353	5.07E-04
BOB_BNB	697.212	5528.848	5.59E-04
BLADE_R	704.994	5580.872	1.56E-04
LVG_GAP	687.859	5528.53	6.03E-04
OM_RVR	683.841	5536.05	6.78E-04
ATRM_EN	682.393	5537.348	7.21E-04
CBN_RDG	679.948	5540.003	8.60E-04
CR_HM_EN	676.24	5544.334	8.41E-04
HNYMNCRK	675.037	5545.114	8.31E-04
BLADE_C	685.82	5539.096	7.70E-04
MCLY_CRK	685.986	5539.089	7.64E-04
DENNIS	696.528	5524.989	5.43E-04
PLT_NE	687.504	5550.972	7.45E-04
PLT_NW	679.139	5564.096	6.55E-04
PLT_SW	681.937	5545.506	8.96E-04
PLT_SE	687.33	5545.703	7.66E-04
RCKP_E	698.281	5548.469	5.39E-04
RCKP_NE	672.08	5576.952	4.33E-04
RCKP_NW	659.402	5576.545	3.34E-04
RCKP_SW	673.238	5534.92	8.05E-04
RCKP_SE	699.604	5536.393	5.48E-04
PLATEAU	714.525	5579.088	1.24E-04
AP	693.35	5519.213	5.30E-04
CABIN	693.409	5515.331	5.11E-04
R2	685.018	5514.27	5.43E-04
R5	693.409	5515.331	5.11E-04
R11	687.682	5510.209	4.94E-04

Appendix L. Concentration Isopleths

Appendix M. Acid Deposition and Vegetation Health Results

Appendix N. Multi-media Risk Model Results – PDC only Scenario

The Pekisko Group

Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines

Livingstone Range – Canadian Rockies

MPOI 50		Units		Value	AI	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Mo	Ni	Se	Th	U	V	Zn	Carc PAH	non-Carc PAH
Receptor		Log Kow		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Predicted soil concentration	mg/kg	---		#VALUE!	2.92E-01	7.19E-01	4.22E+01	2.28E-01	3.06E-01	2.51E+00	2.10E+00	6.62E+00	3.13E+00	#VALUE!	2.60E-02	4.79E-01	6.96E+00	2.78E-01	1.14E-01	4.56E-01	9.13E+00	3.67E+01	1.05E-04	2.59E-02
Baseline soil concentration	---	---		#VALUE!	2.92E-01	7.19E-01	4.22E+01	2.28E-01	3.06E-01	2.51E+00	2.10E+00	6.62E+00	3.13E+00	#VALUE!	2.60E-02	4.79E-01	6.96E+00	2.78E-01	1.14E-01	4.56E-01	9.13E+00	3.67E+01	3.47E-06	8.57E-04
Predicted soil concentration	mg/m3	---		#VALUE!	2.30E-06	5.66E-06	3.33E-04	1.80E-06	2.41E-06	1.98E-05	1.65E-05	5.21E-05	2.46E-05	#VALUE!	2.05E-07	3.77E-06	5.48E-05	2.19E-06	8.99E-07	3.60E-06	7.19E-05	2.89E-04	1.90E-04	2.04E-04
Predicted air concentration	CF ug/mg	0.001		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MPOI 50% Dust Reduction Risk Quotient (HQ or ILCR)																								
Forage	Units	Value		0.004	1.80E-03	6.33E-03	2.00E+00	4.20E-01	1.25E-01	3.00E-03	7.70E-02	8.00E-01	9.20E-02	6.40E-01	1.37E-01	8.00E-01	1.70E-01	1.95E-02	9.90E-02	4.60E-03	5.03E-02	1.00E+00	1.32E-02	4.79E-01
Plant-soil bioconcentration factor for forage/silage, or grain (Bforage)	unitless	COPC specific		0.004	1.80E-03	6.33E-03	2.00E+00	4.20E-01	1.25E-01	3.00E-03	7.70E-02	8.00E-01	9.20E-02	6.40E-01	1.37E-01	8.00E-01	1.70E-01	1.95E-02	9.90E-02	4.60E-03	5.03E-02	1.00E+00	1.32E-02	4.79E-01
Interception fraction of the edible portion of plant (Ip)	unitless	0.5		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Plant surface loss coefficient (kp)	%	18		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Length of plant exposure to deposition per harvest of edible portion of plant (Tp)	unitless	0.5		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Yield or standing crop biomass of the edible portion of the plant (Yp)	year	0.24		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
FORAGE AND SILAGE CONCENTRATION DUE TO DIRECT DEPOSITION	mg/kg	Calculated		#VALUE!	1.05E-08	2.62E-08	1.54E-06	8.32E-09	1.11E-08	9.15E-08	7.65E-08	2.41E-07	1.14E-07	#VALUE!	9.48E-10	1.75E-08	2.54E-07	1.01E-08	4.16E-09	1.66E-08	3.33E-07	1.34E-06	8.78E-07	9.46E-07
FORAGE/SILAGE/GRAIN CONCENTRATION DUE TO ROOT UPTAKE	mg/kg	Calculated		#VALUE!	5.26E-04	4.55E-03	8.44E+01	9.58E-02	3.82E-02	7.53E-03	1.62E-01	5.29E+00	2.88E-01	#VALUE!	3.56E-03	3.83E-01	1.18E+00	5.43E-03	1.13E-02	2.10E-03	4.59E-01	3.67E+01	1.39E-06	1.24E-02
Concentration of COPC in Forage (Pi)	mg/kg	Calculated		#VALUE!	5.26E-04	4.55E-03	8.44E+01	9.58E-02	3.82E-02	7.53E-03	1.62E-01	5.29E+00	2.88E-01	#VALUE!	3.56E-03	3.83E-01	1.18E+00	5.43E-03	1.13E-02	2.10E-03	4.59E-01	3.67E+01	1.39E-06	1.24E-02
TRV/ guideline plant health	---	---		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
HQ	---	---		#VALUE!	2.53E-04	1.80E+01	---	---	---	3.20E+01	---	1.30E+01	7.00E+01	1.20E+01	2.20E+02	---	3.80E+01	5.20E-01	---	---	---	---	---	---
Cattle (Heifer)																								
Soil Ingestion Rate	kg/d	0.5		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Soil bioavailability factor	unitless	1		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Inhalation Rate	m3/d	163.893		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Fraction of plant type (I) grown on contaminated soil and ingested by the animal (Fi)	unitless	0.5		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Quantity of plant type (I) ingested by the animal per day (Qpi)	kg/d	31.25		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Biotransfer factor for beef tissue (Babef)	day/ kg	COPC specific		1.588E-02	1.59E-02	2.00E-03	1.40E-04	1.59E-02	3.50E-03	5.50E-03	4.30E-04	1.59E-02	7.00E-04	6.00E-04	0.00E+00	1.00E-03	6.00E-03	2.00E-03	4.00E-02	3.90E-04	1.59E-02	1.60E-01	9.28E-02	6.28E-02
Biotransfer factor for beef milk (Bamilk)	day/ kg	COPC specific		1.011E-03	1.01E-03	6.00E-05	1.60E-04	8.30E-07	1.90E-04	1.50E-03	1.10E-04	1.01E-03	1.90E-04	4.10E-05	0.00E+00	1.10E-03	1.00E-03	6.00E-03	2.00E-03	1.80E-03	1.01E-03	3.60E-06	1.95E-02	1.32E-02
Body Weight (adult cow)	kg	1250		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Metabolism factor	unitless	1		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Cow daily exposure	mg/kg bw/d	Calculated		#VALUE!	1.62E-01	5.01E-01	2.66E+03	3.11E+00	1.35E+00	1.49E+00	6.10E+00	1.69E+02	1.05E+01	#VALUE!	0.1243436	1.22E+01	4.04E+01	3.09E-01	4.10E-01	2.94E-01	1.89E+01	1.17E+03	9.74E-05	3.89E-01
BEEF TISSUE CONCENTRATION DUE TO PLANT AND SOIL INGESTION	mg/kg	Calculated		#VALUE!	2.58E-03	1.00E-03	3.72E-01	4.93E-02	4.71E-03	8.19E-03	2.62E-03	2.68E+00	7.38E-03	#VALUE!	0.00E+00	1.22E-02	2.43E-01	6.18E-04	1.64E-02	1.15E-04	3.00E-01	1.87E+02	9.04E-06	2.44E-02
BEEF MILK CONCENTRATION DUE TO PLANT AND SOIL INGESTION	mg/kg	Calculated		#VALUE!	8.21E-05	1.50E-05	2.13E-01	1.29E-06	1.28E-04	1.12E-03	3.35E-04	8.53E-02	1.00E-03	#VALUE!	0.00E+00	6.72E-03	2.02E-02	9.26E-04	4.10E-04	2.64E-04	9.55E-03	2.10E-03	9.51E-07	2.57E-03
TRV mg/kg bw/d	---	COPC specific		1.930E+00	5.90E-02	5.18E+01	5.32E-01	7.70E-01	2.40E+00	7.33E+00	5.60E+00	4.70E+00	5.15E+01	1.00E+00	---	1.70E+00	1.43E-01	1.31E-02	---	4.16E+00	7.54E+01	6.15E-01	6.55E+01	6.55E+01
HQ	unitless	Calculated		#VALUE!	2.75E+00	4.82E-01	5.13E+01	5.84E+00	1.75E+00	6.21E-01	8.32E-01	3.01E+01	2.24E+00	#VALUE!	1.24E-01	#VALUE!	2.38E+01	2.16E+00	3.13E+01	#VALUE!	4.54E+00	1.55E+01	1.58E-04	5.94E-03
Cattle (calf)																								
Soil Ingestion Rate	kg/d	0.5		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Soil bioavailability factor	unitless	1		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Inhalation Rate	m3/d	78.743		78.743	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Milk ingestion rate (10% body weight per day)	kg/d	206.800		3.231	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Fraction of plant type (I) grown on contaminated soil and ingested by the animal (Fi)	unitless	0.5		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Quantity of plant type (I) ingested by the animal per day (Qpi)	kg/d	7.81E+00		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Body Weight (fall calf)	kg	5.00E+02		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Metabolism factor	unitless	1		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Calf daily exposure	mg/kg bw/d	Calculated		#VALUE!	4.84E-03	3.68E-02	6.60E+02	7.49E-01	2.99E-01	6.65E-02	1.27E+00	4.16E+01	2.25E+00	#VALUE!	2.79E-02	3.02E+00	9.32E+00	4.58E-02	8.97E-02	1.80E-02	3.63E+00	2.87E+02	5.07E-05	1.05E-01
TRV mg/kg bw/d	---	COPC specific		1.93E+00	5.90E-02	1.04E+00	5.18E+01	5.32E-01	7.70E-01	2.40E+00	7.33E+00	5.60E+00	4.70E+00	5.15E+01	1.00E+00	---	1.70E+00	1.43E-01	1.31E-02	---	4.16E+00	7.54E+01	6.15E-01	6.55E+01
HQ	unitless	Calculated		#VALUE!	8.21E-02	3.53E-02	1.27E+01	1.41E+00	3.89E-01	2.77E-02	1.73E-01	7.43E+00	4.80E-01	#VALUE!	2.79E-02	#VALUE!	5.48E+00	3.21E-01	6.85E+00	#VALUE!	8.73E-01	3.81E+00	8.24E-05	1.61E-03
Human																								
Rancher adult (>20years)	Lifespan	years	80		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Body Weight	kg	70.7		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Soil Ingestion Rate	kg/d	0.00002		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Inhalation Rate	m3/d	16.6		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Beef Ingestion Rate	kg/d	0.00122		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Relative Absorption Factor	unitless	1		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Exposure Duration	unitless	1		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Daily dose -dust inhalation	mg/kg bw/d	Calculated		#VALUE!	5.40E-07	1.33E-06	7.81E-05	4.22E-07	5.66E-07	4.64E-06	3.88E-06	1.22E-05	5.78E-06	#VALUE!	4.81E-08	8.86E-07	1.29E-05	5.15E-07	2.11E-07	8.44E-07	1.69E-05	6.80E-05	4.46E-05	4.80E-05
Daily dose beef mg/kg bw/d	Calculated	#VALUE!		4.45E-08	1.73E-08	6.42E-06	8.52E-07	8.14E-08	1.41E-07	4.53E-08	4.62E-05	1.27E-07	#VALUE!	0.00E+00	2.11E-07	4.19E-06	1.07E-08	2.83E-07	1.98E-09	5.18E-06	3.22E-03	1.56E-10	4.21E-07	
Daily dose (total) mg/kg bw/d	Calculated	#VALUE!		5.85E-07	1.35E-06	8.45E-05	1.27E-06																	

PMPO ID		Log Kow	Units	A	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Hg	Mo	Ni	Se	Th	U	V	Zn	Carc PAH	non-Carc PAH
			0.68											0.73	0.23								6.1	3.3
Predicted soil concentration			mg/kg	#VALUE!	5.840E-01	1.437E+00	8.441E+01	4.563E-01	6.114E-01	5.019E+00	4.198E+00	1.323E+01	6.251E+00	#VALUE!	5.201E-02	9.581E-01	1.392E+01	5.566E-01	2.281E-01	9.125E-01	1.825E+01	7.346E+01	1.050E-04	2.594E-02
Baseline soil concentration														---	---									
Baseline - Predicted Soil Concentration				#VALUE!	5.840E-01	1.437E+00	8.441E+01	4.563E-01	6.114E-01	5.019E+00	4.198E+00	1.323E+01	6.251E+00	#VALUE!	5.201E-02	9.581E-01	1.392E+01	5.566E-01	2.281E-01	9.125E-01	1.825E+01	7.346E+01	1.050E-04	2.594E-02
Predicted air concentration			mg/m3	#VALUE!	4.602E-06	1.132E-05	6.651E-04	3.595E-06	4.817E-06	3.955E-05	3.307E-05	1.043E-04	4.925E-05	#VALUE!	4.098E-07	7.550E-06	1.096E-04	4.386E-06	1.798E-06	7.190E-06	1.438E-04	5.788E-04	1.898E-04	2.043E-04
Baseline																								
CF ug/mg			1.000E-03																					
Soil quality guidelines																								
Forage																								
Plant-soil bioconcentration factor for forage/silage, or grain (Bforforage)				4.000E-03	1.800E-03	6.330E-03	2.000E+00	4.200E-01	1.250E-01	3.000E-03	7.700E-02	8.000E-01	9.200E-02	6.400E-01	1.370E-01	8.000E-01	1.700E-01	1.950E-02	9.900E-02	4.600E-03	5.028E-02	1.000E+00	1.320E-02	4.790E-01
Interception fraction of the edible portion of plant (Rp)		5.000E-01																						
Plant surface loss coefficient (kp)		1.800E+01																						
Length of plant exposure to deposition per harvest of edible portion of plant (Tp)		5.000E-01																						
Yield or standing crop biomass of the edible portion of the plant (yp)		2.400E-01																						
FORAGE AND SILAGE CONCENTRATION DUE TO DIRECT DEPOSITION			#VALUE!	2.130E-08	5.241E-08	3.078E-06	1.664E-08	2.229E-08	1.830E-07	1.531E-07	4.825E-07	2.279E-07	#VALUE!	1.897E-09	3.494E-08	5.074E-07	2.030E-08	8.319E-09	3.327E-08	6.655E-07	2.679E-06	8.785E-07	9.546E-07	
FORAGE/SILAGE/GRAIN CONCENTRATION DUE TO ROOT UPTAKE			#VALUE!	1.051E-03	9.097E-03	1.688E-02	1.918E-01	7.642E-02	1.506E-02	2.322E-01	1.059E+01	5.751E-01	#VALUE!	7.126E-03	7.665E-01	2.364E+00	1.085E-02	2.258E-02	4.198E-03	9.176E-01	7.346E+01	1.387E-06	1.243E-02	
Concentration of CPC in Forage (Pi)			#VALUE!	1.051E-03	9.098E-03	1.688E-02	1.918E-01	7.642E-02	1.506E-02	2.322E-01	1.059E+01	5.751E-01	#VALUE!	7.126E-03	7.665E-01	2.364E+00	1.085E-02	2.258E-02	4.198E-03	9.176E-01	7.346E+01	2.265E-06	1.243E-02	
TRV/ guideline plant health			---	---	1.800E+01	---	---	---	3.200E+01	---	1.300E+01	7.000E+01	1.200E+01	2.200E+02			3.800E+01	5.200E-01				1.600E+02	---	---
HQ			#VALUE!	#VALUE!	5.054E-04	#VALUE!	#VALUE!	2.388E-03	#VALUE!	2.486E-02	1.512E-01	4.792E-02	#VALUE!	#DIV/0!	#DIV/0!	6.225E-02	2.087E-02		#DIV/0!	#DIV/0!	#DIV/0!	4.591E-01	#VALUE!	#VALUE!
Cattle (Heifer)																								
Soil Ingestion Rate		5.000E-01																						
Soil bioavailability factor		1.000E+00																						
Water Ingestion Rate		L/day	2.500E+01																					
Inhalation Rate		m³3/day	1.639E+02																					
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (Fi)		5.000E-01																						
Quantity of plant type (i) ingested by the animal per day (Cpi)		3.125E+01																						
Biota transfer factor for beef tissue (Bamkbf)			1.588E-02	1.588E-02	2.000E-03	1.400E-04	1.588E-02	3.500E-03	5.500E-03	4.300E-04	1.588E-02	7.000E-04	6.000E-04	0.000E+00	1.000E-03	6.000E-03	2.000E-03	4.000E-02	3.900E-04	1.588E-02	1.600E-01	5.404E-03	5.555E-03	
Biota transfer factor for beef milk (Bamklf)			1.011E-03	1.011E-03	6.000E-05	1.600E-04	8.300E-07	1.900E-04	1.500E-03	1.100E-04	1.011E-03	1.900E-04	4.100E-05	0.000E+00	1.100E-03	1.000E-03	6.000E-03	2.000E-03	1.800E-03	1.011E-03	3.600E-06	1.138E-03	1.169E-03	
Body Weight (adult cow)		1.250E+03																						
Metabolism factor		1.000E+00																						
Cow daily exposure		#VALUE!	3.249E-01	1.003E+00	5.318E+03	6.216E+00	2.694E+00	2.980E+00	1.220E-01	3.374E+02	2.110E+01	#VALUE!	2.487E-01	2.443E+01	8.089E+01	6.175E-01	8.198E-01	5.874E-01	3.780E+01	2.332E+03	1.482E-04	4.013E-01		
BEEF Tissue CONCENTRATION DUE TO PLANT AND SOIL INGESTION		#VALUE!	5.157E-03	2.006E-03	7.445E-01	9.869E-02	9.429E-03	1.639E-02	5.246E-03	5.356E+00	1.477E-02	#VALUE!	0.000E+00	2.443E-02	4.853E-01	1.235E-03	3.279E-02	2.291E-04	6.001E-01	3.732E-02	8.008E-07	2.229E-03		
BEEF MILK CONCENTRATION DUE TO PLANT AND SOIL INGESTION		#VALUE!	1.642E-04	3.009E-05	4.254E-01	2.580E-06	2.559E-04	2.235E-03	6.710E-04	1.706E-01	2.204E-03	#VALUE!	0.000E+00	1.344E-02	4.044E-02	1.853E-03	8.198E-04	5.287E-04	1.911E-02	4.198E-03	8.430E-08	2.347E-04		
TRV		1.930E+00	5.900E-02	1.040E+00	5.180E-01	5.320E-01	7.700E-01	2.400E+00	7.330E+00	5.600E+00	4.700E+00	5.150E+01	1.000E+00	-	1.700E+00	1.430E-01	1.310E-02	-	4.160E+00	7.540E-01	6.150E-01	6.550E+01		
HQ		#VALUE!	5.506E+00	9.643E-01	1.027E+02	1.169E+01	3.499E+00	1.242E+00	1.664E+00	6.025E+01	4.489E+00	#VALUE!	2.487E-01	#VALUE!	4.759E+01	4.318E+00	6.258E+01	#VALUE!	9.086E+00	3.093E+01	2.410E-04	6.127E-03		
Cattle (calf)																								
Soil Ingestion Rate		5.000E-01																						
Soil bioavailability factor		1.000E+00																						
Water Ingestion Rate		L/day	2.500E+01																					
Inhalation Rate		m³3/day	7.874E+01																					
Milk ingestion rate (10% body weight per day)		L/day	3.231E+00																					
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (Fi)		5.000E-01																						
Quantity of plant type (i) ingested by the animal per day (Cpi)		7.813E+00																						
Body Weight (full calf)		5.000E+02																						
Metabolism factor		1.000E+00																						
Calf daily exposure		#VALUE!	9.690E-03	7.350E-02	1.320E+03	1.498E+00	5.989E-01	1.130E-01	2.534E+00	8.327E+01	4.509E+00	#VALUE!	5.575E-02	6.033E+00	1.864E+01	9.169E-02	1.795E-01	3.598E-02	7.260E+00	5.740E+02	1.496E-02	1.140E-01		
TRV		1.930E+00	5.900E-02	1.040E+00	5.180E-01	5.320E-01	7.700E-01	2.400E+00	7.330E+00	5.600E+00	4.700E+00	5.150E+01	1.000E+00	-	1.700E+00	1.430E-01	1.310E-02	-	4.160E+00	7.540E-01	6.150E-01	6.550E+01		
HQ		#VALUE!	1.642E-01	7.067E-02	2.549E+01	2.815E+00	7.778E-01	5.541E-02	3.457E-01	1.487E+01	9.594E-01	#VALUE!	5.575E-02	#VALUE!	1.096E+01	6.412E-01	1.370E+01	#VALUE!	1.745E+00	7.613E+00	2.433E-02	1.740E-03		
Human																								
Daily exposure																								
ranh adult (>20years)																								
bw		7.070E+01																						
soil IR		2.000E-05																						
inhalation rate		1.660E+01																						
water IR		1.500E+00																						
beef IR		1.220E-03																						
RAF		1.000E+00																						
ET		1.000E+00																						
Daily dose - inhalation		#VALUE!	1.080E-06	2.659E-06	1.562E-04	8.441E-07	1.131E-06	9.285E-06	7.766E-06	2.448E-05	1.156E-05	#VALUE!	9.623E-08	1.773E-06	2.575E-05	1.030E-06	4.220E-07	1.688E-06	3.376E-05	1.359E-04	4.457E-05	4.798E-05		
Daily dose - beef		#VALUE!	8.899E-08	3.461E-08	1.285E-05	1.703E-06	1.607E-07	2.826E-07	9.052E-08	9.241E-05	2.548E-07	#VALUE!	0.000E+00	4.218E-07	8.375E-06	2.131E-08	5.659E-07	3.953E-09	1.036E-05	6.439E-03	1.382E-11	1.347E-08		
Daily dose - (total)		#VALUE!	1.169E-06	2.694E-06	1.690E-04	2.547E-06	1.294E-06	9.568E-06	7.856E-06	1.169E-04	1.182E-05	#VALUE!	9.623E-08	2.194E-06	3.412E-05	1.051E-06	9.879E-07	1.692E-06	4.412E-05	6.575E-03	4.457E-05	4.802E-05		
TRV		1.000E+00	4.000E-04	2.000E-01	2.000E-03	1.000E-03	1.000E-03	1.000E-03	1.000E-03	1.000E-03	1.100E-01	1.300E-03	1.560E-01	3.000E-04	2.800E+01	1.100E-02	5.700E+00	1.000E-05	6.000E-04	1.800E+00	5.700E-01	2.000E-02		
HQ		#VALUE!	2.924E-03	1.800E+00	8.450E-04	1.274E-03	1.294E-03	9.568E-03	7.856E-03	8.291E-04	9.092E-03	#VALUE!	3.208E-04	7.836E-08	3.102E-03	1.844E-07	9.879E-02	2.820E-03	2.451E-05	1.154E-02	2.300E+00	1.300E-01		
Oral Slope Factor		Calculated		2.700E+01																				
Inhalation Slope Factor		Calculated		6.230E-08																				
ILCR oral		Calculated																						
ILCR inhalation		Calculated																						
ILCR total		Calculated																						
ranh child (5-11)																								
bw		3.290E+01																						
soil IR		8.000E-05										</												

[illegible]

		Units	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Hg	Mo	Ni	Se	Th	U	V	Zn	Carc PAH	non-Carc PAH	
	Log Kow			0.68							0.73	0.23	0.62		0.57						6.1	3.3	
Soil Concentration		mg/kg	#VALUE!	1.97E-03	4.84E-03	2.84E-01	1.54E-03	2.06E-03	1.69E-02	1.41E-02	4.45E-02	2.10E-02	#VALUE!	1.75E-04	3.22E-03	4.68E-02	1.87E-03	7.68E-04	3.07E-03	6.14E-02	2.47E-01	5.91E-06	1.46E-03
Baseline (https://aac-aecic.gc.ca/050/documents/p80101/115613E.pdf)																							
			#VALUE!	1.97E-03	4.84E-03	2.84E-01	1.54E-03	2.06E-03	1.69E-02	1.41E-02	4.45E-02	2.10E-02	#VALUE!	1.75E-04	3.22E-03	4.68E-02	1.87E-03	7.68E-04	3.07E-03	6.14E-02	2.47E-01	5.91E-06	1.46E-03
Soil Concentration		mg/m3	#VALUE!	1.54835E-08	3.8104E-08	2.23785E-06	1.20965E-08	1.6209E-08	1.3306E-07	1.1288E-07	3.50799E-07	1.65722E-07	#VALUE!	1.379E-09	2.54E-08	3.68943E-07	1.47577E-08	6.04825E-09	2.4193E-08	4.8386E-07	1.94754E-06	2.83E-07	1.15E-05
Baseline																							
	CF ug/mg	0.001																					
Soil quality guidelines																							
Forage																							
Plant-soil bioconcentration factor for forage/silage, or grain (Bforage)		0.004	0.0018	0.00633	2	0.42	0.125	0.003	0.077	0.8	0.092	0.64	0.137	0.8	0.17	0.0195	0.099	0.0046	0.050276667	1	0.0132	0.479	
Interception fraction of the edible portion of plant (Rp)	0.5																						
Plant surface loss coefficient (Rp)	18																						
Length of plant exposure to deposition per harvest of edible portion of plant (Tp)	0.5																						
Yield or standing crop biomass of the edible portion of the plant (Tpi)	0.24																						
FORAGE AND SILAGE CONCENTRATION DUE TO DIRECT DEPOSITION	#VALUE!	7.16557E-11	1.7634E-10	1.03565E-08	5.5981E-11	7.10551E-11	6.1579E-10	5.15025E-10	1.62345E-09	7.6694E-10	#VALUE!	6.3818E-12	1.176E-10	1.70742E-09	6.82968E-11	2.79905E-11	1.11962E-10	2.23924E-09	9.01294E-09	1.30968E-09	5.32151E-08		
FORAGE/SILAGE/GRAIN CONCENTRATION DUE TO ROOT UPTAKE	#VALUE!	3.53707E-06	3.06109E-05	0.568019836	0.000644779	0.00025714	5.0661E-05	0.001087528	0.0315616379	0.00194952	#VALUE!	2.3977E-05	0.0025791	0.007959954	3.65221E-05	7.59918E-05	1.41237E-05	0.003087367	0.247165388	7.80245E-08	0.000699232		
Concentration of COPC in Forage (Pi)	#VALUE!	3.53715E-06	3.06111E-05	0.568019846	0.000644779	0.00025714	5.0662E-05	0.001087528	0.0315616381	0.00194953	#VALUE!	2.3977E-05	0.0025791	0.007959955	3.65222E-05	7.59919E-05	1.41238E-05	0.003087369	0.247165397	7.93342E-08	0.000699285		
TRV/ guideline plant health		18				32		13	70	12	220				38				160				
HQ	#VALUE!	#VALUE!	1.70062E-06	#VALUE!	#VALUE!	8.0358E-06	#VALUE!	8.3656E-05	0.000508805	0.000161246	#VALUE!	#DIV/0!	#DIV/0!	0.000209473	0.0235E-05	#DIV/0!	#DIV/0!	#DIV/0!	0.001544784	#VALUE!	#VALUE!		
Cattle (Heifer)																							
Soil Ingestion Rate	0.5																						
Soil bioavailability factor	1																						
Water Ingestion Rate	L/day	25.00																					
Inhalation Rate	m³3/day	163.893																					
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (Fi)	0.5																						
Quantity of plant type (i) ingested by the animal per day (Qpi)	31.25																						
Biotransfer factor for beef tissue (Babef)	1.59E-02	0.015875714	0.002	0.00014	0.015875714	0.0035	0.0055	0.00043	0.015875714	0.0007	6.00E-04	0	0.001	0.006	0.002	0.04	0.00039	0.015875714	0.16	0.092780276	0.062797245		
Biotransfer factor for beef milk (Bamilk)	1.01E-03	0.001011043	0.00006	0.00016	0.000000083	0.00019	0.0015	0.00011	0.001011043	0.00019	4.10E-05	0	0.0011	0.001	0.006	0.002	0.0018	0.001011043	0.0000036	0.01953269	0.013220511		
Body Weight (adult cow)	1250																						
Metabolism factor	1																						
Cow daily exposure	#VALUE!	0.001093059	0.000374523	17.89263545	0.02091695	0.00906433	0.01002674	0.04104734	1.153272174	0.09883335	#VALUE!	0.000836377	0.0822094	0.272160282	0.00207786	0.0003758544	0.001976562	0.127184234	7.847501608	5.47177E-06	0.023584045		
BEEF Tissue CONCENTRATION DUE TO PLANT AND SOIL INGESTION	#VALUE!	1.73831E-05	6.74905E-06	0.002504968	0.000312072	1.1725E-05	5.5147E-05	1.76503E-05	0.018002357	4.96883E-05	#VALUE!	0	8.221E-05	0.001632963	4.15557E-06	0.000110342	7.70859E-07	0.002019139	1.255600257	5.07073E-07	0.00141822		
BEEF Milk CONCENTRATION DUE TO PLANT AND SOIL INGESTION	#VALUE!	5.52656E-07	1.01236E-07	0.00143141	8.68053E-09	8.611E-07	7.5301E-06	2.25795E-06	0.000573904	6.74342E-06	#VALUE!	0	4.522E-05	0.00013608	6.23336E-06	2.75845E-06	1.77891E-06	6.42943E-06	1.41255E-05	5.34395E-08	0.000149286		
TRV	1.93E+00	5.90E-02	1.04E+00	5.18E+01	5.32E-01	7.70E-01	2.40E+00	7.33E+00	5.60E+00	4.70E+00	5.15E+01	1.00E+00	-	1.70E+00	1.43E-01	1.31E-02	4.16E+00	7.54E+01	6.15E+01	6.55E+01			
HQ	#VALUE!	0.018526418	0.003244734	0.34541484	0.039312575	0.01177386	0.00417785	0.000559983	0.020277124	0.015102837	#VALUE!	0.000836377	#VALUE!	0.160094283	0.014529973	0.210575874	#VALUE!	0.030573107	0.104078271	8.89719E-06	0.000344755		
Cattle (calf)																							
Soil Ingestion Rate	0.5																						
Soil bioavailability factor	1																						
Water Ingestion Rate	L/day	25.00																					
Inhalation Rate	m³3/day	78.743																					
Milk ingestion rate (10% body weight per day)	L/day	3.231																					
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (Fi)	0.5																						
Quantity of plant type (i) ingested by the animal per day (Qpi)	7.81E+00																						
Body Weight (calf calf)	5.00E+02																						
Metabolism factor	1																						
Calf daily exposure	#VALUE!	3.26037E-05	0.000247312	4.442740517	0.005039854	0.00201505	0.00044746	0.008526496	0.280179545	0.015172689	#VALUE!	0.0001876	0.0203007	0.062702735	0.000308506	0.000603844	0.000211066	0.02442733	1.931425827	2.30824E-05	0.00685245		
TRV	1.93E+00	5.90E-02	1.04E+00	5.18E+01	5.32E-01	7.70E-01	2.40E+00	7.33E+00	5.60E+00	4.70E+00	5.15E+01	1.00E+00	-	1.70E+00	1.43E-01	1.31E-02	4.16E+00	7.54E+01	6.15E+01	6.55E+01			
HQ	#VALUE!	0.000552605	0.0002378	0.085767191	0.00947334	0.000261695	0.000186444	0.001163233	0.050032062	0.003228232	#VALUE!	0.0001876	#VALUE!	0.036883962	0.002157387	0.040494953	#VALUE!	0.005871954	0.025615727	3.75324E-05	0.000104618		
Human																							
Daily exposure																							
ranch adult (>20years)																							
	bw	70.7																					
	soil IR	0.00002																					
	inhalation rate	16.6																					
	water IR	1.5																					
	beef IR	0.00122																					
	ET	1																					
	Daily dose -dust inhalation	#VALUE!	3.63545E-09	8.94662E-09	5.25436E-07	2.8402E-09	3.8059E-09	3.1242E-08	2.61298E-08	8.23657E-08	3.89107E-08	#VALUE!	3.2378E-10	5.964E-09	8.6626E-08	3.46504E-09	1.4201E-09	5.68039E-09	1.13608E-07	4.57272E-07	6.64467E-08	2.69987E-06	
	Daily dose beef	#VALUE!	2.99445E-10	1.16462E-10	4.32257E-08	5.73023E-09	5.4745E-10	9.5162E-10	3.04573E-10	3.1101E-07	8.57422E-10	#VALUE!	0	1.419E-09	2.81784E-08	7.17086E-11	1.90406E-09	1.3302E-11	3.48423E-08	2.16667E-08	8.7604E-12	2.44728E-08	
	Daily dose (total)	#VALUE!	3.9349E-09	9.06308E-09	5.68662E-07	8.57043E-09	4.5333E-09	3.2149E-08	2.64344E-08	3.93375E-07	3.97081E-08	#VALUE!	3.2378E-10	7.383E-09	1.14804E-07	3.53675E-09	3.32416E-09	5.6937E-09	1.4845E-07	2.21239E-05	6.64554E-08	2.72434E-06	
	TRV	0.0004	1.8	0.2	6.45952E-06	7.8673E-06	0.001	0.001	0.001	0.141	0.0013	0.156	2.003E-06	29	1.81651E-05	1.0634E-09	0.0000158103	1.78902E-05	1.44049E-07	0.57	2.3	0.02	
	HQ	#VALUE!	8.93724E-06	1.63135E-08	2.84331E-06	4.28521E-06	4.3533E-06	3.2194E-05	2.64344E-05	2.7899E-06	3.05090E-05	#VALUE!	1.0793E-06	2.637E-10	1.04368E-05	6.20482E-10	0.000332416	9.48494E-06	8.24723E-08	3.88139E-05	1.52848E-07	0.000136217	
Oral Slope Factor Calculated																							
Inhalation Slope Factor Calculated																							
ICR oral	Calculated																						
ICR oral	Calculated																						
ICR total	Calculated																						
ranch child (5-11)																							
	bw	32.9																					
	soil IR	0.00008																					
	inhalation rate	14.5																					
	water IR	0.8																					
	beef IR	0.00075																					
	Daily dose -dust inhalation	#VALUE!	6.8E-09	1.7E-08	9.9E-07	5.3E-09	7.1E-09	5.9E-08	4.9E-08	1.5E-07	7.3E-08	#VALUE!	6.1E-10	1.1E-08	1.6E-07	6.5E-09	2.7E-09	1.1E-08	2.1E-07	8.6E-07	1.2E-07	5.1E-06	
	Daily dose beef	#VALUE!	3.95587E-10	1.53854E-10	5.71041E-08	7.57002E-09	7.2322E-10	1.2572E-09	4.02632E-10	4.30865E-07													

[illegible]

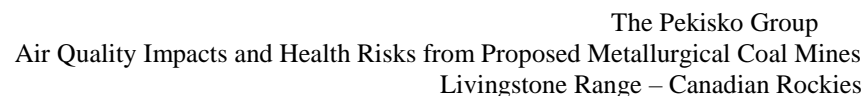
The Pekisko Group

Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines

Livingstone Range – Canadian Rockies

Plateau 0	Units	Al	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Hg	Mo	Ni	Se	Th	U	V	Zn	Carc PAH	non-Carc PAH
Log Kow				0.68							0.73	0.23	0.62		0.57						6.1	3.3
Soil Concentration	mg/kg	#VALUE!	7.33E-03	1.80E-02	1.06E+00	5.73E-03	7.68E-03	6.30E-02	5.27E-02	1.66E-01	7.85E-02	#VALUE!	6.53E-04	1.20E-02	1.75E-01	6.99E-03	2.86E-03	1.15E-02	2.29E-01	9.22E-01	1.74E-05	4.29E-03
Baseline (https://aac-aec.gc.ca/050/documents/p80101/115613E.pdf)																						
Air Concentration	mg/m3	#VALUE!	7.33E-03	1.80E-02	1.06E+00	5.73E-03	7.68E-03	6.30E-02	5.27E-02	1.66E-01	7.85E-02	#VALUE!	6.53E-04	1.20E-02	1.75E-01	6.99E-03	2.86E-03	1.15E-02	2.29E-01	9.22E-01		
Baseline		#VALUE!	5.77747E-08	1.4218E-07	8.35025E-06	4.51365E-08	6.0483E-08	4.965E-07	4.15256E-07	1.30896E-06	6.1837E-07	#VALUE!	5.1456E-09	9.479E-08	1.37666E-06	5.50665E-08	2.25683E-08	9.0273E-08	1.80546E-06	7.26698E-06	8.31E-07	3.38E-05
CF ug/mg	0.001																					
Soil quality guidelines																						
Forage																						
Plant-soil bioconcentration factor for forage/silage, or grain (Bforage)	0.5	0.004	0.0018	0.00633	2	0.42	0.125	0.003	0.077	0.8	0.092	0.64	0.137	0.8	0.17	0.0195	0.099	0.0046	0.050276667	1	0.0132	0.479
Interception fraction of the edible portion of plant (Rp)	18																					
Plant surface loss coefficient (Kp)	0.5																					
Length of plant exposure to deposition per harvest of edible portion of plant (Tp)	0.24																					
Yield or standing crop biomass of the edible portion of the plant (Yp)		#VALUE!	2.67374E-10	6.5799E-10	3.86439E-08	2.08886E-10	2.7991E-10	2.2977E-09	1.92175E-09	6.05769E-09	2.86173E-09	#VALUE!	2.3813E-11	4.387E-10	6.37102E-09	2.54841E-10	1.04443E-10	4.17771E-10	8.35543E-09	3.36306E-08	3.84545E-09	1.56249E-07
FORAGE AND SILAGE CONCENTRATION DUE TO DIRECT DEPOSITION		#VALUE!	1.31981E-05	0.000114221	2.119491367	0.002405909	0.0009595	0.00018904	0.004057967	0.132897837	0.007220019	#VALUE!	8.9465E-05	0.0096236	0.029701521	0.000136278	0.000283554	5.27009E-05	0.011520104	0.922265163	2.29094E-07	0.002053066
FORAGE/SILAGE/GRAIN CONCENTRATION DUE TO ROOT UPTAKE		#VALUE!	1.31984E-05	0.000114221	2.119491406	0.002405909	0.0009595	0.00018904	0.004057969	0.132897843	0.007220022	#VALUE!	8.9465E-05	0.0096236	0.029701527	0.000136278	0.000283554	5.27013E-05	0.011520112	0.922265196	2.32939E-07	0.002053222
Concentration of COPC in Forage (Pi)		---	---	18	---	---	32	---	13	70	12	---	---	220	---	38	---	0.52	---	160	---	---
TRV guideline plant health		#VALUE!	#VALUE!	6.34562E-06	#VALUE!	#VALUE!	2.9984E-05	#VALUE!	0.000312151	0.001898541	0.000601668	#VALUE!	#DIV/0!	#DIV/0!	0.000781619	0.000262073	#DIV/0!	#DIV/0!	#DIV/0!	0.005764157	#VALUE!	#VALUE!
HQ		#VALUE!	#VALUE!	6.34562E-06	#VALUE!	#VALUE!	2.9984E-05	#VALUE!	0.000312151	0.001898541	0.000601668	#VALUE!	#DIV/0!	#DIV/0!	0.000781619	0.000262073	#DIV/0!	#DIV/0!	#DIV/0!	0.005764157	#VALUE!	#VALUE!
Cattle (Heifer)																						
Soil Ingestion Rate	0.5																					
Soil bioavailability factor	1																					
Water Ingestion Rate	L/day	25.00																				
Inhalation Rate	m³/day	163.893																				
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (Fi)	0.5																					
Quantity of plant type (i) ingested by the animal per day (Qpi)	31.25																					
Bioretransfer factor for beef tissue (Babef)		1.59E-02	0.015875714	0.002	0.00014	0.015875714	0.0035	0.0055	0.00043	0.015875714	0.0007	6.00E-04	0	0.001	0.006	0.002	0.04	0.00039	0.015875714	0.16	0.092780276	0.062797425
Bioretransfer factor for beef milk (Bamk)		1.01E-03	0.001011043	0.00006	0.00016	0.00000083	0.00019	0.0015	0.00011	0.001011043	0.00019	4.10E-05	0	0.0011	0.001	0.006	0.002	0.0018	0.001011043	0.0000036	0.01953269	0.013220511
Body Weight (adult cow)	1250																					
Metabolism factor	1																					
Cow daily exposure		#VALUE!	0.004078605	0.01259159	66.76398037	0.07804885	0.0382237	0.03741346	0.153162008	4.236118918	0.264864987	#VALUE!	0.00312231	0.3067534	1.015530323	0.007752986	0.010293144	0.007375282	0.474570845	29.38192091	7.38829E-06	0.064167626
BEEF Tissue CONCENTRATION DUE TO PLANT AND SOIL INGESTION		#VALUE!	6.47508E-05	2.51832E-05	0.009346957	0.001239081	0.0001838	0.00020577	6.58997E-05	0.067251414	0.000185405	#VALUE!	0	0.0003068	0.006093182	1.5506E-05	0.000411726	2.87636E-06	0.007534151	4.685107346	6.85488E-07	0.004029562
BEEF MILK CONCENTRATION DUE TO PLANT AND SOIL INGESTION		#VALUE!	2.06182E-06	3.77748E-07	0.005341118	3.23903E-08	3.2131E-06	2.806E-05	8.42391E-06	0.002114449	2.51623E-05	#VALUE!	0	0.0001687	0.000507765	2.3259E-05	1.02931E-05	6.63775E-06	0.000239906	5.27075E-05	7.21566E-08	0.000424164
TRV		1.93E+00	5.90E-02	1.04E+00	5.18E+01	5.32E-01	7.70E-01	2.40E+00	7.33E+00	5.60E+00	4.70E+00	5.15E+01	1.00E+00	-	1.70E+00	1.43E-01	1.31E-02	-	4.16E+00	7.54E+01	6.15E-01	6.55E+01
HQ		#VALUE!	0.069128894	0.012107298	1.28887993	0.146708365	0.04392516	0.01558894	0.020895226	0.756449807	0.056354253	#VALUE!	0.00312231	#VALUE!	0.597370778	0.054216683	0.785736198	#VALUE!	0.11407953	0.388354389	1.20135E-05	0.000979658
Cattle (calf)																						
Soil Ingestion Rate	0.5																					
Soil bioavailability factor	1																					
Water Ingestion Rate	L/day	25.00																				
Inhalation Rate	m³/day	78.743																				
Milk ingestion rate (10% body weight per day)	L/day	3.231																				
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (Fi)	0.5																					
Quantity of plant type (i) ingested by the animal per day (Qpi)	7.81E+00																					
Body Weight (calf calf)	5.00E+02																					
Metabolism factor	1																					
Calf daily exposure		#VALUE!	0.000121656	0.000922814	16.57750236	0.018805554	0.00751891	0.00166964	0.031815499	1.045453149	0.056614894	#VALUE!	0.00070001	0.0757493	0.233967015	0.001151151	0.002253164	0.000451742	0.091147373	7.206861642	6.74829E-05	0.020069933
TRV		1.93E+00	5.90E-02	1.04E+00	5.18E+01	5.32E-01	7.70E-01	2.40E+00	7.33E+00	5.60E+00	4.70E+00	5.15E+01	1.00E+00	-	1.70E+00	1.43E-01	1.31E-02	-	4.16E+00	7.54E+01	6.15E-01	6.55E+01
HQ		#VALUE!	0.002061972	0.000887321	0.320022903	0.035348785	0.00976482	0.00069568	0.00434045	0.186688062	0.012045722	#VALUE!	0.00070001	#VALUE!	0.137627656	0.008050005	0.17199726	#VALUE!	0.021910426	0.095581719	0.000109728	0.000306411
Human																						
Daily exposure																						
ranch adult (>20years)																						
bw	70.7																					
soil IR	0.00002																					
inhalation rate	16.6																					
water IR	1.5																					
beef IR	0.00122																					
RAF	1																					
ET	1																					
Daily dose -dust inhalation		#VALUE!	1.35652E-08	3.33831E-08	1.9606E-06	1.05978E-08	1.4201E-08	1.1658E-07	9.74999E-08	3.07337E-07	1.4519E-07	#VALUE!	1.2082E-09	2.226E-08	3.23234E-07	1.29293E-08	5.29891E-09	2.11956E-08	4.23913E-07	1.70625E-06	1.95099E-07	7.92728E-08
Daily dose beef		#VALUE!	1.11734E-09	4.34561E-10	1.61291E-07	2.13816E-08	2.0427E-09	3.5508E-09	1.13648E-09	1.16049E-06	3.19936E-09	#VALUE!	0	5.293E-09	1.05144E-07	2.67571E-10	7.10474E-09	4.96345E-11	1.30009E-07	8.08463E-05	1.18288E-11	6.95342E-08
Daily dose (total)		#VALUE!	1.46825E-08	3.38177E-08	2.12189E-06	3.19794E-08	1.6244E-08	1.2013E-07	9.86364E-08	1.46783E-06	1.48389E-07	#VALUE!	1.2082E-09	2.755E-08	4.28378E-07	1.31969E-08	1.24037E-08	2.12453E-08	5.53922E-07	8.25525E-05	1.95111E-07	7.99681E-06
TRVs	1	0.0004			0.2	0.002	0.001	0.001	0.001	0.141	0.0013	0.156	0.0003	28	0.011	5.7	0.00001	0.0006	1.8	0.57		0.02
HQ		#VALUE!	3.67064E-05		1.06094E-05	1.59897E-05	1.6244E-05	0.0001203	9.86364E-05	1.04101E-05	0.000114146	#VALUE!	4.0272E-06	8.939E-10	3.89434E-05	2.31525E-09	0.001240365	3.54088E-05	3.07735E-07	0.000144829		0.000399841
Oral Slope Factor	Calculated																					

Appendix O. Multi-media Risk Model Results – PDC and Baseline Scenario



1

The Pekisko Group

Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines

Livingstone Range – Canadian Rockies

MPOI 0	Log Row	Units	Al	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Hg	Mo	Ni	Se	Th	U	V	Zn	Carc PAH	non-Carc PAH
					0.68							0.73	0.23	0.62		0.57						6.1	3.3
Predicted soil concentration			#VALUE!	5.840E-01	1.437E+00	8.441E-01	4.563E-01	6.114E-01	5.019E+00	4.198E+00	1.323E+01	6.251E+00	#VALUE!	5.201E-02	9.581E-01	1.392E+01	5.566E-01	2.281E-01	9.125E-01	1.825E+01	7.346E+01	1.050E-04	2.594E-02
Baseline soil concentration		mg/kg	---	1.160E+00	4.570E+00	2.420E+02	1.000E+00	1.380E+00	6.580E+00	6.900E+00	3.280E+01	1.150E+01	---	---	2.100E+00	3.020E+01	1.140E+00	5.000E+00	2.000E+00	2.630E+01	1.330E+02		
Baseline +Predicted Soil Concentration			#VALUE!	1.744E+00	6.007E+00	3.264E+02	1.456E+00	1.991E+00	1.160E+01	1.110E+01	4.603E+01	1.775E+01	#VALUE!	5.201E-02	9.581E-01	4.412E+01	1.697E+00	5.228E+00	2.913E+00	4.455E+01	2.065E+02	1.050E-04	2.594E-02
Predicted air concentration		mg/m3	#VALUE!	4.602E-06	1.132E-05	6.651E-04	3.595E-06	4.817E-06	3.955E-05	3.307E-05	1.043E-04	4.925E-05	#VALUE!	4.098E-07	7.550E-06	1.096E-04	4.386E-06	1.798E-06	7.190E-06	1.438E-04	5.788E-04	1.898E-04	2.043E-04
Baseline																							
CF ug/mg		1.000E-03																					
Soil quality guidelines																							
Forage																							
Plant-soil bioconcentration factor for forage/silage, or grain (Bforage)			4.000E-03	1.800E-03	6.330E-03	2.000E+00	4.200E-01	1.250E-01	3.000E-03	7.700E-02	8.000E-01	9.200E-02	6.400E-01	1.370E-01	8.000E-01	1.700E-01	1.950E-02	9.900E-02	4.600E-03	5.028E-02	1.000E+00	1.320E-02	4.790E-01
Interception fraction of the edible portion of plant (Rp)		5.000E-01																					
Plant surface loss coefficient (kp)		1.800E+01																					
Length of plant exposure to deposition per harvest of edible portion of plant (Tp)		5.000E-01																					
Yield or standing crop biomass of the edible portion of the plant (Yp)		2.400E-01																					
FORAGE AND SILAGE CONCENTRATION DUE TO DIRECT DEPOSITION			#VALUE!	2.130E-08	5.241E-08	3.078E-06	1.664E-08	2.229E-08	1.830E-07	1.531E-07	4.825E-07	2.279E-07	#VALUE!	1.897E-09	3.494E-08	5.074E-07	2.030E-08	8.319E-09	3.327E-08	6.655E-07	2.679E-06	8.785E-07	9.456E-07
FORAGE/SILAGE/GRAIN CONCENTRATION DUE TO ROOT UPTAKE			#VALUE!	1.051E-03	9.097E-03	1.688E+02	1.916E-01	7.642E-02	1.506E-02	3.232E-01	1.059E+01	5.751E-01	#VALUE!	7.126E-03	7.665E-01	2.366E+00	1.085E-02	2.258E-02	4.198E-03	9.176E-01	7.346E+01	1.387E-06	1.243E-02
Concentration of COPC in Forage (Pi)			#VALUE!	1.051E-03	9.098E-03	1.688E+02	1.916E-01	7.642E-02	1.506E-02	3.232E-01	1.059E+01	5.751E-01	#VALUE!	7.126E-03	7.665E-01	2.366E+00	1.085E-02	2.258E-02	4.198E-03	9.176E-01	7.346E+01	2.265E-06	1.243E-02
TRV guideline plant health			---	---	1.800E+01	---	---	3.200E+01	---	1.300E+01	7.000E+01	1.200E+01	2.200E+02	---	---	3.800E+01	5.200E-01	---	---	---	---	---	---
HQ			#VALUE!	#VALUE!	5.054E-04	#VALUE!	#VALUE!	2.388E-03	#VALUE!	2.486E-02	1.512E-01	4.792E-02	#VALUE!	#DIV/0!	#DIV/0!	6.225E-02	2.087E-02	#DIV/0!	#DIV/0!	#DIV/0!	4.591E-01	#VALUE!	#VALUE!
Cattle (heifer)																							
Soil Ingestion Rate		5.000E-01																					
Soil bioavailability factor		1.000E+00																					
Water Ingestion Rate		L/day	2.500E+01																				
Inhalation Rate		m³/day	1.639E+02																				
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (Fi)		5.000E-01																					
Quantity of plant type (i) ingested by the animal per day (Cpi)		3.125E+01																					
Biotransfer factor for beef tissue (Babeef)			1.588E-02	1.588E-02	2.000E-03	1.400E-04	1.588E-02	3.500E-03	1.500E-03	4.900E-04	1.588E-02	7.000E-04	6.000E-04	0.000E+00	1.000E-03	6.000E-03	2.000E-03	4.000E-02	3.900E-04	1.588E-02	1.600E-01	5.404E-03	5.555E-03
Biotransfer factor for beef milk (Bamilk)			1.011E-03	1.011E-03	6.000E-05	1.600E-04	8.300E-07	1.900E-04	1.500E-03	1.100E-04	1.011E-03	1.900E-04	4.100E-05	0.000E+00	1.100E-03	1.000E-03	6.000E-03	2.000E-03	1.800E-03	1.011E-03	3.800E-06	1.138E-03	1.169E-03
Body Weight (adult cow)		1.250E+03																					
Metabolism factor		1.000E+00																					
Cow daily exposure			#VALUE!	9.049E-01	3.288E+00	5.439E+03	6.716E+00	3.384E+00	6.270E+00	1.565E+01	3.538E+02	2.685E+01	#VALUE!	2.487E-01	2.443E+01	9.599E+01	1.188E+00	3.320E+00	1.587E+00	5.095E+01	2.399E+03	1.482E-04	4.013E-01
BEEF TISSUE CONCENTRATION DUE TO PLANT AND SOIL INGESTION			#VALUE!	1.437E-02	6.576E-03	7.614E-01	1.066E-01	1.184E-02	3.448E-02	6.729E-03	5.617E+00	1.879E-02	#VALUE!	0.000E+00	2.443E-02	5.759E-01	2.375E-03	1.328E-01	6.191E-04	8.088E-01	3.838E+02	8.008E-07	2.229E-03
BEEF MILK CONCENTRATION DUE TO PLANT AND SOIL INGESTION			#VALUE!	4.574E-04	9.864E-05	4.351E-01	2.787E-06	3.215E-04	4.702E-03	8.607E-04	1.789E-01	2.550E-03	#VALUE!	0.000E+00	1.344E-02	4.799E-02	3.563E-03	3.320E-03	1.429E-03	2.576E-02	4.318E-03	8.430E-08	2.347E-04
TRV			1.930E+00	5.900E-02	1.040E+00	5.180E+01	5.320E-01	7.700E-01	4.400E+00	7.330E+00	5.600E+00	4.700E+00	5.150E+01	1.000E+00	-	1.700E+00	1.430E-01	1.310E-02	-	4.160E+00	7.540E+01	6.150E-01	6.550E+01
HQ			#VALUE!	1.534E+01	3.161E+00	1.050E+02	1.262E+01	4.395E+00	2.612E+00	2.135E+00	6.318E+01	5.712E+00	#VALUE!	2.487E-01	#VALUE!	5.646E+01	8.304E+00	2.534E+02	#VALUE!	1.225E+01	3.181E+01	2.410E-04	6.127E-03
Cattle (calf)																							
Soil Ingestion Rate		5.000E-01																					
Soil bioavailability factor		1.000E+00																					
Water Ingestion Rate		L/day	2.500E+01																				
Inhalation Rate		m³/day	7.874E+01																				
Milk ingestion rate (10% body weight per day)		L/day	3.231E+00																				
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (Fi)		5.000E-01																					
Quantity of plant type (i) ingested by the animal per day (Cpi)		7.813E+00																					
Body Weight (fall calf)		5.000E+02																					
Metabolism factor		1.000E+00																					
Calf daily exposure			#VALUE!	1.180E-02	7.829E-02	1.321E+03	1.499E+00	6.005E-01	1.475E-01	2.542E+00	8.333E+01	4.523E+00	#VALUE!	5.575E-02	6.033E+00	1.869E+01	9.835E-02	1.925E-01	4.089E-02	7.308E+00	5.741E+02	1.496E-02	1.140E-01
TRV			1.930E+00	5.900E-02	1.040E+00	5.180E+01	5.320E-01	7.700E-01	4.400E+00	7.330E+00	5.600E+00	4.700E+00	5.150E+01	1.000E+00	-	1.700E+00	1.430E-01	1.310E-02	-	4.160E+00	7.540E+01	6.150E-01	6.550E+01
HQ			#VALUE!	2.000E-01	7.528E-02	2.550E+02	2.817E+00	7.798E-01	6.147E-02	3.467E-01	1.488E+01	9.622E-01	#VALUE!	5.575E-02	#VALUE!	1.099E+01	6.878E-01	1.470E-01	#VALUE!	1.757E+00	7.615E+00	2.433E-02	1.740E-03
Human																							
Daily exposure																							
ranch adult (>20years)																							
bw		7.070E-01																					
soil IR		2.000E-05																					
inhalation rate		1.660E+01																					
water IR		1.500E+00																					
beef IR		1.220E-03																					
RAF		1.000E+00																					
ET		1.000E+00																					
Daily dose - inhalation		#VALUE!	1.080E-06	2.659E-06	1.562E-04	8.441E-07	1.131E-06	9.285E-06	7.766E-06	2.448E-05	1.156E-05	#VALUE!	9.623E-08	1.773E-06	2.575E-05	1.030E-06	4.220E-07	1.688E-06	3.376E-05	1.359E-04	4.457E-05	4.798E-05	
Daily dose beef		#VALUE!	2.479E-07	1.135E-07	1.314E-05	1.840E-06	2.044E-07	5.951E-07	1.161E-07	9.692E-05	3.243E-07	#VALUE!	0.000E+00	4.216E-07	9.938E-06	4.098E-06	2.291E-06	1.068E-08	1.396E-05	6.623E-03	1.382E-11	3.847E-08	
Daily dose (total)		#VALUE!	1.328E-06	2.772E-06	1.693E-04	2.684E-06	1.335E-06	9.880E-06	7.892E-06	1.214E-04	1.188E-05	#VALUE!	9.623E-08	2.194E-06	3.568E-05	1.071E-06	2.714E-06	1.699E-06	4.772E-05	6.759E-03	4.457E-05	4.892E-05	
TRVs		#VALUE!	1.000E+00	4.000E-04	2.000E-01	2.000E-03	1.000E-03	1.000E-03	1.000E-03	1.410E-01	1.300E-03	1.560E-03	3.000E-04	2.800E+01	1.100E-02	5.700E+00							

3

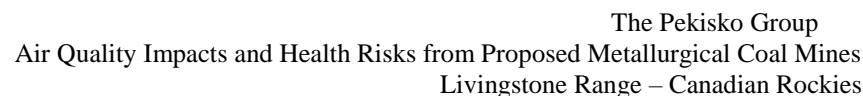
The Pekisko Group

Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines

Livingstone Range – Canadian Rockies

Model	Units	Al	Sb	Au	Ba	Be	Cd	Cr	Co	Cu	Pb	Mn	Hg	Mb	Ni	Se	Tb	U	V	Zn	Carc PAH	non-Carc PAH
Predicted soil concentration	Log Kow	1.97E-03	4.84E-03	2.84E-01	1.54E-03	2.00E-03	1.69E-02	1.43E-02	4.45E-02	2.10E-02	0.73	0.23	0.62	1.75E-04	4.68E-02	1.87E-03	7.68E-04	3.07E-03	6.14E-02	2.47E-01	6.1	3.3
Baseline soil concentration	mg/kg	---	1.16E+00	4.57E+00	2.42E+02	1.00E+00	1.38E+00	6.98E+00	6.90E+00	3.38E+01	1.15E+01	---	---	2.10E+00	3.02E+01	1.14E+00	5.00E+00	2.00E+00	2.63E+01	1.13E+02	5.91E-06	1.46E-03
Baseline +Predicted Soil Concentration		1.16E+00	4.57E+00	2.42E+02	1.00E+00	1.38E+00	6.98E+00	6.90E+00	6.91E+00	3.28E+01	1.15E+01	1.15E+01	1.15E+01	2.10E+00	3.02E+01	1.14E+00	5.00E+00	2.00E+00	2.64E+01	1.13E+02	5.91E-06	1.46E-03
Predicted air concentration	mg/m3	1.54835E-08	3.8104E-08	2.23785E-06	1.20955E-08	1.62095E-08	1.33062E-07	1.11288E-07	3.50799E-07	1.65723E-07	1.1379E-09	2.54027E-08	3.6843E-07	1.47577E-08	6.04825E-09	2.4193E-08	4.8386E-07	1.94754E-06	2.83E-07	1.15E-05		
CF ug/mg	0.001																					
Soil quality guidelines																						
Forage																						
Plant-soil bioconcentration factor for forage/silage, or grain (Bforage)		0.004	0.0018	0.00033	2	0.42	0.125	0.003	0.077	0.8	0.002	0.64	0.137	0.8	0.17	0.0295	0.009	0.0046	0.050274667	1	0.0132	0.479
Interception fraction of the edible portion of plant (f _p)	0.5																					
Plant surface loss coefficient (f _{pl})	0.5																					
Length of plant exposure to deposition per harvest of edible portion of plant (t)	0.24																					
Yield or standing crop biomass of the edible portion of the plant (Y _p)		7.16557E-11	1.70361E-10	1.03656E-08	5.58831E-11	7.50545E-11	6.11795E-10	5.15025E-10	1.62345E-09	7.66940E-10	1.15E-09	6.38183E-12	1.1756E-10	1.70742E-09	6.82968E-11	2.79955E-11	1.11963E-10	2.28240E-09	9.01294E-09	1.30968E-09	5.32155E-08	
FORAGE AND SILAGE CONCENTRATION DUE TO DIRECT DEPOSITION		3.53707E-06	3.06125E-05	0.568039836	0.00044779	0.000257344	5.06618E-05	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	
FORAGE/SILAGE/GRAIN CONCENTRATION DUE TO ROOT UPTAKE		3.53707E-06	3.06125E-05	0.568039836	0.00044779	0.000257344	5.06618E-05	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	0.001987528	
Concentration of COPC in Forage (P)		1.16E+00	4.57E+00	2.42E+02	1.00E+00	1.38E+00	6.98E+00	6.90E+00	6.91E+00	3.28E+01	1.15E+01	1.15E+01	1.15E+01	2.10E+00	3.02E+01	1.14E+00	5.00E+00	2.00E+00	2.64E+01	1.13E+02	5.91E-06	1.46E-03
TRV guideline plant health		1.16E+00	4.57E+00	2.42E+02	1.00E+00	1.38E+00	6.98E+00	6.90E+00	6.91E+00	3.28E+01	1.15E+01	1.15E+01	1.15E+01	2.10E+00	3.02E+01	1.14E+00	5.00E+00	2.00E+00	2.64E+01	1.13E+02	5.91E-06	1.46E-03
HQ		1.16E+00	4.57E+00	2.42E+02	1.00E+00	1.38E+00	6.98E+00	6.90E+00	6.91E+00	3.28E+01	1.15E+01	1.15E+01	1.15E+01	2.10E+00	3.02E+01	1.14E+00	5.00E+00	2.00E+00	2.64E+01	1.13E+02	5.91E-06	1.46E-03
Cattle (heifer)																						
Soil Ingestion Rate	0.5																					
Soil bioavailability factor	1																					
Water Ingestion Rate	L/day	25.00																				
Inhalation Rate	m ³ /day	163.893																				
Fraction of plant type (i) grown on contaminated soil and ingested by the animal	0.5																					
Quantity of plant type (i) ingested by the animal per day (Q _{pi})	31.25																					
Biotransfer factor for beef tissue (B _{beef})	1.59E-02	0.015875714	0.002	0.00014	0.015875714	0.0005	0.0005	0.00043	0.015875714	0.0007	6.00E-04	0	0.001	0.006	0.002	0.04	0.00039	0.015875714	0.16	0.09776276	0.962797425	
Biotransfer factor for beef milk (B _{milk})	1.01E-03	0.001015943	0.00056	0.00016	0.0000088	0.00009	0.0001	0.00011	0.000101943	0.00019	4.10E-05	0	0.0011	0.001	0.006	0.002	0.0018	0.001015943	0.000006	0.01915269	0.010230511	
Body Weight (adult cow)	1250																					
Metabolism factor	1																					
Cow daily exposure		0.581093059	2.888374523	138.8926254	0.52091695	0.69904335	3.300026738	3.49104714	17.5357217	5.82088335	1.15E-09	1.13209864	15.37216038	0.572077786	2.50278544	1.001976562	13.27738412	74.3479161	5.47177E-06	0.022584043		
BEF: TISSUE CONCENTRATION DUE TO PLANT AND SOIL INGESTION		0.000225267	0.004576749	0.019444968	0.00028999	0.000446705	0.018150447	0.00150115	0.278384971	0.00474688	1.15E-09	0.001132009	0.00232962	0.00144156	0.001103942	0.000390771	0.210784782	11.89560035	5.07673E-07	0.00043822		
BEF: MILK CONCENTRATION DUE TO PLANT AND SOIL INGESTION		0.000293755	6.86512E-05	0.01111141	2.16181E-07	6.64116E-05	0.00047502	0.000030008	0.00086466	0.000552993	1.15E-09	0.000622715	0.00768608	0.00176233	0.000502759	0.000001779	0.000671901	0.000133826	5.34301E-08	0.000140386		
TRV	1.93E+00	5.90E-02	1.04E+00	5.18E+01	5.32E-01	7.70E-01	2.40E+00	7.33E+00	5.60E+00	4.70E+00	5.15E+01	1.00E+00	1.70E+00	1.43E-01	1.31E-02	1.46E+00	5.15E-01	6.15E-01	6.15E-01	6.15E-01		
HQ		0.84034852	2.200300129	2.681324816	0.979197599	0.907875759	1.37502141	0.47628368	3.11298623	1.23057093	1.15E-09	1.13209864	15.37216038	0.572077786	2.50278544	1.001976562	13.27738412	74.3479161	5.47177E-06	0.022584043		
Cattle (calf)																						
Soil Ingestion Rate	0.5																					
Soil bioavailability factor	1																					
Water Ingestion Rate	L/day	25.00																				
Inhalation Rate	m ³ /day	78.743																				
Milk ingestion rate (10% body weight per day)	L/day	3.231																				
Fraction of plant type (i) grown on contaminated soil and ingested by the animal	0.5																					
Quantity of plant type (i) ingested by the animal per day (Q _{pi})	7.83E+00																					
Body Weight (full calf)	5.00E+02																					
Metabolism factor	1																					
Calf daily exposure		0.002140014	0.000238015	4.716020017	0.00045025	0.003360693	0.01000569	0.010363626	0.330783889	0.028437759	1.15E-09	0.001132009	0.00232962	0.00144156	0.001103942	0.000390771	0.210784782	11.89560035	5.07673E-07	0.00043822		
TRV	1.93E+00	5.90E-02	1.04E+00	5.18E+01	5.32E-01	7.70E-01	2.40E+00	7.33E+00	5.60E+00	4.70E+00	5.15E+01	1.00E+00	1.70E+00	1.43E-01	1.31E-02	1.46E+00	5.15E-01	6.15E-01	6.15E-01	6.15E-01		
HQ		0.036271424	0.004640014	0.091042818	0.01135437	0.004884238	0.000250237	0.00218816	0.00672927	0.00050587	1.15E-09	0.001132009	0.00232962	0.00144156	0.001103942	0.000390771	0.210784782	11.89560035	5.07673E-07	0.00043822		
Human																						
Daily exposure																						
ranch adult (>20years)																						
bw	70.7																					
soil IR	0.00002																					
inhalation rate	16.6																					
water IR	1.5																					
beef IR	0.00122																					
IR _{all}	1																					
ET	1																					
Daily dose -dust inhalation		1.69E-09	8.94602E-09	5.25438E-07	2.8402E-09	3.89088E-09	3.12423E-08	2.1128E-08	8.2367E-08	3.89187E-08	1.15E-09	3.22782E-10	5.98441E-08	8.663E-08	3.4604E-09	1.4305E-09	5.88039E-09	1.18008E-07	4.17772E-07	6.6402E-08	2.8887E-06	
Daily dose -beef		1.99391E-07	7.89746E-08	3.35431E-07	1.42706E-07	4.22075E-08	3.11995E-07	2.59039E-08	8.80181E-06	7.03129E-08	1.15E-09	3.22782E-10	5.98441E-08	8.663E-08	3.4604E-09	1.4305E-09	5.88039E-09	1.18008E-07	4.17772E-07	6.6402E-08	2.8887E-06	
Daily dose (total)		1.62827E-07	8.79233E-08	8.60979E-07	1.45482E-07	4.60368E-08	3.4441E-07	5.20337E-08	4.88181E-06	1.0924E-07	1.15E-09	3.22782E-10	5.98441E-08	8.663E-08	3.4604E-09	1.4305E-09	5.88039E-09	1.18008E-07	4.17772E-07	6.6402E-08	2.8887E-06	
TRV	0.0004	1.6	0.2	0.002	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	
HQ		0.00047067	1.58262E-07	4.34089E-06	7.27331E-05	4.60066E-05	0.00034441	5.20337E-05	3.46538E-05	8.40181E-05	1.15E-09	3.22782E-10	5.98441E-08	8.663E-08	3.4604E-09							

Pasture so		Units	Se	Sr	Hv	Bc	Bs	Cd	Cr	Ea	Gz	Ng	Mn	Ng	Mn	Ve	Ge	Zk	U	V	Zn	Carc PAH 6.1	non Carc PAH 3.3
Predicted soil concentration		Log Row	#VALUE!	3.67E-03	9.00E-03	5.30E-01	2.86E-03	3.94E-03	3.15E-02	2.64E-02	8.31E-02	3.95E-02	#VALUE!	3.37E-04	6.01E-03	8.74E-02	3.49E-03	1.43E-03	5.75E-03	1.15E-01	4.63E-01	3.49E-06	6.57E-04
Baseline soil concentration		mg/kg	---	1.16E+00	4.57E+00	2.42E+02	1.00E+00	1.38E+00	6.59E+00	6.90E+00	3.28E+01	1.15E+01	---	---	2.10E+00	3.02E+01	1.14E+00	5.00E+00	2.00E+00	2.64E+01	1.33E+02	---	---
Baseline +Predicted Soil Concentration		#VALUE!	1.16E+00	4.58E+00	2.43E+02	1.00E+00	1.38E+00	6.61E+00	6.93E+00	3.29E+01	1.15E+01	#VALUE!	3.27E-04	2.11E+00	3.03E+01	1.14E+00	5.00E+00	2.01E+00	2.64E+01	1.33E+02	---	---	
Predicted air concentration		mg/m3	#VALUE!	2.88874E-08	7.309E-08	4.17513E-06	2.25638E-08	3.02413E-08	2.48251E-07	2.07628E-07	6.54479E-07	3.09185E-07	#VALUE!	2.57278E-09	4.79933E-08	6.88332E-07	2.75333E-08	1.12841E-08	4.51306E-08	9.0273E-07	3.6349E-06	1.66E-07	6.75E-06
Baseline		CF ug/kg	0.001																				
Soil quality guidelines																							
Forage																							
Plant soil bioconcentration on factor for forage/haylage, or grain (Bforage)			0.004	0.0038	0.00333	2	0.42	0.125	0.003	0.077	0.8	0.002	0.64	0.137	0.8	0.17	0.0385	0.099	0.096	0.05076657	1	0.032	0.478
Interception fraction of the edible portion of plant (I _p)		0.5																					
Plant surface loss coefficient (R _s)		18																					
Length of plant tissue exposed to deposition per harvest of edible portion of plant (T _p)		0.5																					
Yield or standing crop biomass of the edible portion of the plant (Y _p)		0.24																					
FORAGE AND SILAGE CONCENTRATION DUE TO DIRECT DEPOSITION		#VALUE!	1.33687E-10	3.28995E-10	1.93239E-08	1.0443E-10	1.39953E-10	1.14887E-09	9.8062E-10	3.03844E-09	1.43087E-09	#VALUE!	1.19005E-11	2.1933E-10	3.18501E-09	1.2742E-10	5.22244E-11	2.08896E-10	4.17771E-09	1.48153E-08	7.69091E-10	3.12497E-08	
FORAGE/SILAGE/GRAIN CONCENTRATION DUE TO ROOT UPTAKE		#VALUE!	6.59907E-01	5.74393E-05	1.05976E-04	0.00232955	0.00247975	8.44379E-05	0.00202864	0.00464852	0.00261011	#VALUE!	4.47327E-05	0.00431818	0.01480704	6.81396E-05	0.00041777	2.83046E-05	0.00576056	0.04123261	4.65876E-08	0.00241664	
Concentration of Cd/Cr in Forage (%)		#VALUE!	6.5990E-01	5.71026E-05	1.05974E-03	0.00232955	0.0047975	9.4336E-05	0.00202864	0.00464852	0.00261011	#VALUE!	4.47327E-05	0.00431818	0.01480704	6.81396E-05	0.00041777	2.83046E-05	0.00576056	0.04123261	4.65876E-08	0.00241664	
TRV guideline plant health		HQ	---	---	18	---	32	---	13	70	12	220	---	38	0.52	---	---	---	---	---	---	---	---
IHQ		#VALUE!	#VALUE!	3.17281E-06	#VALUE!	#VALUE!	1.49922E-05	#VALUE!	0.000156076	0.00049827	0.000000834	#VALUE!	RDV/D1	RDV/D1	0.00019061	0.000113036	RDV/D1	RDV/D1	RDV/D1	RDV/D1	0.002802079	#VALUE!	#VALUE!
Cattle (heifer)																							
Soil Ingestion Rate		0.5																					
Soil bioavailability factor		1																					
Water Ingestion Rate		L/day	25.00																				
Inhalation Rate		m³³/day	163.893																				
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (F _i)		0.5																					
Quantity of plant type (i) ingested by the animal per day (Q _p)		31.25																					
Biotransfer factor for beef tissue (B _{beef})		#VALUE!	1.59E-02	0.03875734	0.002	0.00014	0.01875734	0.0035	0.0005	0.00043	0.01587574	0.0007	6.00E-04	0	0.001	0.006	0.002	0.04	0.00039	0.03387574	0.16	0.02780276	0.067797425
Biotransfer factor for beef milk (B _{milk})		#VALUE!	1.53E-03	0.03031043	0.00006	0.00016	0.00000883	0.00019	0.0003	0.00011	0.00011043	0.00019	4.10E-05	0	0.0011	0.006	0.002	0.0018	0.00011043	0.0000006	0.00953089	0.033220511	
Metabolism factor		1290																					
Cow daily exposure		#VALUE!	0.58039392	2.29129579	154.3819902	0.539024425	0.706911187	3.30876078	3.52608048	18.11805946	5.88242499	#VALUE!	0.001561156	1.203376719	0.015760536	0.573897693	2.505146572	1.009847641	3.173385247	81.14909604	1.47766E-06	0.01283925	
BEEF TISSUE CONCENTRATION DUE TO PLANT AND SOIL INGESTION		#VALUE!	0.00904029	0.00482592	0.021613479	0.00057398	0.002474189	0.008197887	0.00315643	0.29398821	0.004117703	#VALUE!	0	0.001203377	0.009464091	0.001147753	0.000205863	0.000391438	0.212532718	12.98255367	1.37098E-07	0.000809592	
BEEF MILK CONCENTRATION DUE TO PLANT AND SOIL INGESTION		#VALUE!	0.000294233	6.87388E-06	0.021305059	2.23695E-07	6.71566E-05	0.00248153	0.000319962	0.009363276	0.000508831	#VALUE!	0	0.000663857	0.000703883	0.001721629	0.002005147	0.000033139	0.006767638	0.000046054	1.44313E-08	8.48329E-05	
TRV		1.93E+00	5.90E-02	1.04E+00	5.18E-01	5.32E-01	7.70E-01	2.40E+00	7.33E-00	5.60E+00	4.70E+00	5.15E+01	1.00E+00		1.70E+00	1.43E-01		4.16E+00	7.54E-01	6.15E-01	6.55E-01		
HQ		#VALUE!	9.86072921	2.20130934	2.38034703	1.01335806	0.91806476	1.378627893	0.8116099	3.304798332	1.251361382	#VALUE!	0.001561156	#VALUE!	1.18103833	0.01422328	0.01225628	#VALUE!	3.12807457	1.07640059	2.4027E-06	0.00035932	
Cattle (calf)																							
Soil Ingestion Rate		0.5																					
Soil bioavailability factor		1																					
Water Ingestion Rate		L/day	25.00																				
Inhalation Rate		m³³/day	78.743																				
Milk ingestion rate (30% body weight per day)		L/day	3.233																				
Fraction of plant type (i) grown on contaminated soil and ingested by the animal (F _i)		0.5																					
Quantity of plant type (i) ingested by the animal per day (Q _p)		7.81E+00																					
Body Weight (F _{bf} calf)		5.00E+02																					
Metabolism factor		1																					
Calf daily exposure		#VALUE!	0.802186239	0.005329609	0.002659682	0.004013447	0.003512365	0.01387938	0.004308979	0.580315419	0.045157317	#VALUE!	0.000350004	0.041840704	0.171579445	0.007741013	0.014054707	0.005133996	0.091935766	3.736817601	1.39966E-05	0.004013987	
TRV		1.93E+00	5.90E-02	1.04E+00	5.18E-01	5.32E-01	7.70E-01	2.40E+00	7.33E+00	5.60E+00	4.70E+00	5.15E+01	1.00E+00		1.70E+00	1.43E-01		4.16E+00	7.54E-01	6.15E-01	6.55E-01		
HQ		#VALUE!	0.30679806	0.00050674	0.06350406	0.009553582	0.008949695	0.008411636	0.010350209	0.10384896	0.008845216	#VALUE!	0.000350004	0.000300005	0.000636453	1.08432672	#VALUE!	0.020430029	0.049559915	2.13956E-05	6.1282E-05		
Human																							
Daily exposure																							
ranch adult (>20years)		bw	70.7																				
		soil IR	0.00002																				
		inhalation rate	16.6																				
		water IR	1.5																				
		beef IR	0.00122																				
		RAF	1																				
		ET	1																				
Daily dose -dust inhalation		#VALUE!	6.78261E-09	1.68916E-08	9.8029E-07	5.28991E-07	7.10054E-09	5.8288E-08	4.875E-08	1.53688E-07	7.29951E-08	#VALUE!	6.04078E-10	1.11777E-08	1.63617E-07	6.46467E-09	2.64949E-09	1.05979E-08	2.11996E-07	8.53127E-07	1.90288E-08	1.58546E-06	
Daily dose -beef		#VALUE!	2.10564E-07	1.04607E-07	1.24485E-07	1.88077E-07	4.14645E-07	4.39885E-08	5.07050E-06	7.30551E-08	#VALUE!	1.1E-09	2.18428E-08	2.10484E-06	3.28435E-06	2.38435E-06	8.59346E-06	0.000259555	1.22312E-05	1.87176E-06	3.06E-06		
Daily dose -total (TRV)		#VALUE!	1.66213E-07	9.53588E-08	1.15326E-06	1.57906E-07	4.97923E-08	3.72111E-07	7.49175E-08	5.28721E-06	1.4386E-07	#VALUE!	6.04078E-10	1.18932E-08	1.77788E-07	2.62703E-08	1.73138E-06	1.79373E-08	3.87942E-06	0.000224889	3.90222E-08	1.59938E-06	
Soil IR		1	0.0004		0.2	0.002	0.001	0.001	0.001	0.001	0.001	0.136	0.0003	28	0.011	5.7	0.0001	0.0006	1.8	0.57	0.02		
HQ		#VALUE!	0.00045583	6.7663E-06	7.64627E-05	4.97923E-05	0.000731311	7.49175E-08	3.76988E-05	0.0001105	#VALUE!	2.01109E-08	1.13904E-09	0.000310398	4.6083E-09	0.171380396	2.89038E-05	2.15524E-06	0.000394527	2.3	7.96681E-05		
Oral Slope Factor		Calculated		1.8																			
Inhalation Slope Factor		Calculated		27																			
ELCR oral		Calculated		1.42339E-07																	5.44424E-12		
ELCR inhalation		Calculated		4.50872E-07																	5.07788E-09		
ELCR total		Calculated		5.93811E-07																	5.07802E-09		
ranch child (5-11)																							
		bw	32.9																				
		soil IR	0.00008																				
		inhalation rate	14.5																				
		beef IR	0.8																				
		RAF	0.00075																				
Daily dose -dust inhalation		#VALUE!	1.3E-08	3.1E-08	1.8E-06	9.9E-09	1.3E-08	1.1E-07	9.2E-08	2.9E-07	1.4E-07	#VALUE!	1.1E-09	2.1E-08	3.0E-07	1.2E-08	5.0E-09	2.0E-08	4.0E-07	1.6E-06	7.3		

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The Pekisko Group
Air Quality Impacts and Health Risks from Proposed Metallurgical Coal Mines
Livingstone Range – Canadian Rockies
